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OFFICE OF
STATE ENTOMOLOGIST
ST. ANTHONY PARK, MINN.

CIRCULAR NO. 28
JAN. 20, 1914

FUMIGATION OF GREENHOUSES WITH CYANIDE

~~[illegible]~~
URBANA, ILLINOIS, U. S. A.

LETTER OF TRANSMITTAL.

Minnesota Experiment Station,
St. Anthony Park, Minn.,
January 20, 1914

His Excellency,
A. O. EBERHART.

Dear Sir:—I have the honor to transmit herewith the manuscript of a paper entitled "Fumigation of Greenhouses with Cyanide," by Professor William Moore, of the Division of Entomology of the Minnesota Experiment Station.

This is an important topic for florists throughout the state and I respectfully recommend its publication as Circular No. 28, of the State Entomologist's Department, which, by law, is under your supervision.

Respectfully yours,
F. L. WASHBURN,
State Entomologist.

Approved:
A. O. EBERHART,
Governor of Minnesota.

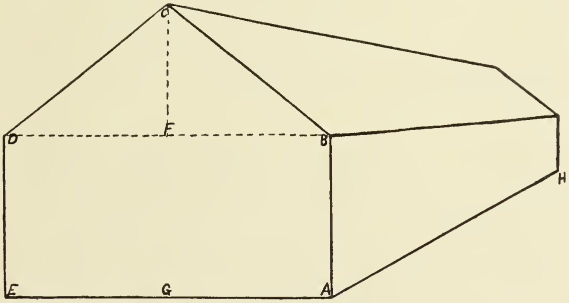
OFFICE OF
STATE ENTOMOLOGIST
ST. ANTHONY PARK, MINN.

CIRCULAR NO. 28
JAN. 20, 1914

FUMIGATION OF GREENHOUSES WITH CYANIDE

Fumigation with cyanide gas has come into general use to destroy scale insects upon citrus trees such as oranges, lemons, etc., the fumigation of nursery stock to destroy various insect pests, the fumigation of houses to destroy bed bugs, and also the fumigation of mills and grain elevators to destroy grain insects. Cyanide has also been used in the fumigation of greenhouses, but not as extensively as in the above cases. The reason for this is that oftentimes, the fumigation of the greenhouse results in injury to the plants growing there.

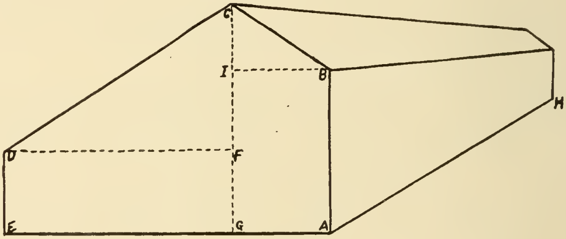
In the fumigation of greenhouses, there are a number of factors to be taken into consideration. The most important factor is to have the greenhouse accurately measured, so that one can accurately estimate the exact dose of cyanide which is necessary to kill the insect pests and not destroy the plants.



Fig, 1.

Fig. 1 shows a view of a greenhouse which has both the slanting roofs equal and the height of each side equal. Such a house is very easily measured and the number of cubic feet determined. To estimate the number of cubic feet in a house of this kind, the height AB is multiplied by the width AE and the result multiplied by the length AH. This gives the number of cubic feet of space in the rectangular portion ABDE-H. The upper portion is still to be estimated. For this purpose, take the height CG and subtract from it AB, the height of the side. This will give the height of the line CF, which multiplied by the width FB (which equals GA or half AE) will give the number of square feet in two triangles, each the size of CBF or, in other words, it gives the number of square feet in the section BCD, inasmuch as the triangle CDF is equal to the triangle CBF. The number of square feet in BCD is multiplied by the length AH, giving the number of cubic feet in the upper portion of the greenhouse; which, added to the number of cubic feet in the lower portion, gives the capacity of the greenhouse in cubic feet.

Many greenhouses have the sides unequal and the slopes of the house unequal, as shown in Fig. 2. In such a greenhouse, one must measure the height AB by the width of the rectangular portion ABIG, which width is AG, G being a point immediately underneath the highest portion of the roof. This, multiplied by AH, the length, gives the number of cubic feet in this portion. The same is done for the rectangular portion DEGF. We then have two triangular portions still to compute. Multiplying CI by IB and dividing by 2 gives the number of square feet in the portion CIB, which is then multiplied by AH to obtain the capacity in cubic feet. The same is done for the triangle DCF; that is, DF is multiplied by CF and half of the result is multiplied by the length AH.



Big. 2.

The number of cubic feet in these four sections are then added together to give the sum total of cubic feet in the greenhouse.

After having carefully estimated the number of cubic feet, the next point to determine is the amount of cyanide to be used. This varies according to the plants which are present. Some plants are more susceptible to cyanide gas than other plants and where there are a number of different plants in same house, the amount of cyanide to be used should be such that it will not injure the most tender variety. Two other factors which are most important are the temperature and the humidity in the house. Plants are always more readily injured in a house where the temperature is high, say 70 or 80 degrees, than they are when the temperature is lower, as for example, 60 degrees. The more moisture in the house, the more apt the plants are to be injured, so that the house should be just as dry as is possible, considering the plants which are in it. Some plants can never be fumigated or have never been successfully fumigated. Roses, carnations, and chrysanthemums have, in most all cases, been injured by cyanide so that if these plants are present, they should be removed from the house about to be fumigated.

Plants should not be watered just before fumigation. In fact, it would be well if the plants had not been watered for twenty-four hours before the process. The temperature should be low and the fumigation must be done at night; even on a cloudy day, it is apt to burn the foliage, while some entomologists seem to think it advisable not to fumigate on a bright moonlight night. The materials used in fumigation with cyanide are potassium cyanide, sulphuric acid, and water. The usual formula is

1 oz. potassium cyanide.
1 or 2 fluid ounces sulphuric acid.
3 fluid ounces water.

Some prefer to use as much as six fluid ounces of water to one ounce of sulphuric acid. The more water that is used, the slower the gas is generated and the more evenly it is probably distributed. The sulphuric acid is slowly added to the water, which is contained in an earthenware jar, constantly stirring. The earthenware jar is necessary, inasmuch as metal will be acted upon by the sulphuric acid. The resulting mixture will be hot and the cyanide is added to it while still hot. The gas is extremely poisonous as is also the case with the potassium cyanide. For that reason, it is best not to be in the house at the time that the cyanide is to be placed in the jars. This can be arranged by putting the cyanide in bags tied to a string which is supported from the ceiling by a screw eye, thus allowing the other end of the string to be extended to the outside of the house. The cyanide can then be lowered into a jar while the person is on the outside of the house. If heavy bags are used for the cyanide, the jars can be placed in order and bag placed beside the jar. When all is ready, move rapidly along the row of jars placing the bags in the acid and leave the house at once.

When a large greenhouse is to be fumigated, it would be well to have several jars, so that the gas will be thoroughly distributed throughout the greenhouse. Ventilators should be arranged in such a way that they can be opened from the outside to air the house. One should be careful to remove their cats or any other pets from the house before the fumigation is started. If the cat is forgotten, one should not go into the house to get it after the cyanide is started; in fact, under no circumstances should the house be entered after the fumigation is started until such time as the house has been thoroughly ventilated. The dose which is in general use is from one ounce to five ounces of potassium cyanide per thousand cubic feet. It would we well to first try the lighter dose and if the insects are not killed and the plants are uninjured, a stronger dose should be used.

Fumigation is of value for a number of insects, for example: White Fly, Violet Aphis or Green Fly of violets, Green Fly, Mealy Bugs, Scale Insects, Thrips, etc. Some are more easily killed than others and in most cases a strong dose for a short period will be more beneficial and less apt to injure the plants than a milder dose continued for a longer period. One florist, who also raises truck crops in the greenhouse, says that he regularly and successfully fumigates with one ounce to the thousand cubic feet, over night, without injuring the plants. Three ounces of cyanide to a thousand cubic feet has been used successfully on ferns, while the double English violets will stand a dose of six ounces to a thousand cubic feet without injury. Single violets as the California and the Princess of Wales have been slightly injured by six ounces so that it will be advisable to use about four ounces in that case. The temperature of the house has to be 60° or a little bit above and the time of the dose about a half an hour. Five ounces to a thousand cubic feet have been used over night for cucumbers without injuring the plants in the least, while the author knows of a case where no account was taken of temperature or humidity, the temperature having been about 75° and the humidity probably great, where one ounce to a thousand cubic feet for five hours severely injured the cucumbers. Cucumbers are always apt to be injured if in fruit at the time. One ounce to a thousand cubic feet has been used for tomatoes without injury. One-third of an ounce to a thousand cubic feet has proven very beneficial for the Green Fly on lettuce, radishes, and similar plants, without injury. Cyanide is particularly beneficial for Green Fly on violets since violets cannot be fumigated with tobacco. Cyanide will not always kill the Red Spider, although probably killing many of the older specimens, usually leaving the eggs and probably some young which will serve to continue the pest.

A number of factors in the fumigation of greenhouses are still to be determined and the author would be glad to hear from any one who has fumigated greenhouses, giving the effects of the fumigation and also the conditions under which fumigation was done.

In closing, considering our present knowledge of greenhouse pests, it would be well to advise the use of not more than one ounce of cyanide to each thousand cubic feet for over night use, and not more than three ounces per thousand cubic feet for fumigation of a half hour. If either of these doses are used and the insects are not killed while the plants show no injury, the amount of cyanide per thousand cubic feet could be increased but not exceeding five or six ounces per thousand cubic feet as a maximum quantity.

WILLIAM MOORE,
Chief of Section of Truck Crop and Greenhouse Insects.

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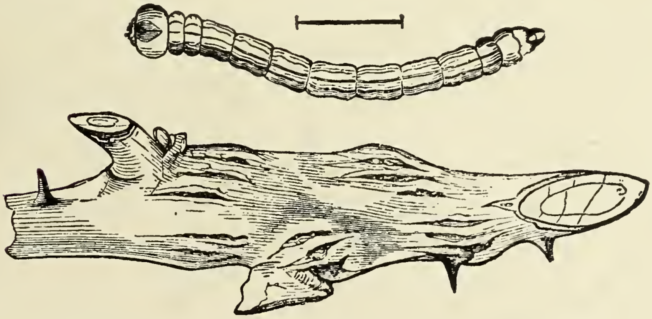
OFFICE OF
STATE ENTOMOLOGIST
ST. ANTHONY PARK, MINN.

CIRCULAR No. 29
JAN. 20, 1914

TWO RASPBERRY PESTS WHICH MAY BE CONTROLLED BY SPRING PRUNING



Agrilus ruficollis, Fab. Gall and larva.—After Riley.

LETTER OF TRANSMITTAL.

Minnesota Experiment Station,
St. Anthony Park, Minn.,
January 20, 1914

His Excellency,
A. O. EBERHART.

Dear Sir:—I have the honor to transmit herewith the manuscript of a paper entitled "Two Raspberry Pests Which May Be Controlled by Spring Pruning," by Professor William Moore, of the Division of Entomology of the Minnesota Experiment Station.

The berry industry is an important one in Minnesota and this paper is to be regarded as valuable for those engaged in this business. I, therefore, respectfully recommend its publication as Circular No. 29, of the State Entomologist's Department, which, by law, is under your supervision.

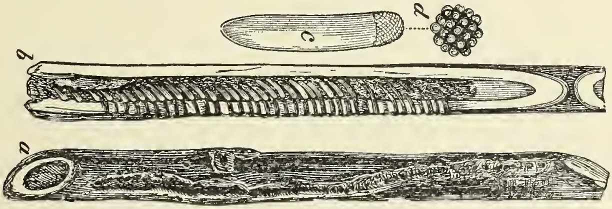
Respectfully yours,
F. L. WASHBURN,
State Entomologist.

Approved:
A. O. EBERHART,
Governor of Minnesota.

OFFICE OF
STATE ENTOMOLOGIST
ST. ANTHONY PARK, MINN.

CIRCULAR NO. 29
JAN. 20, 1914

TWO RASPBERRY PESTS WHICH MAY BE CONTROLLED BY SPRING PRUNING



Eggs of *Oecanthus*. (*a*) twig, showing puncture; (*b*) twig split open to show eggs; (*c*) a single egg; (*d*) cap of egg enlarged. After Riley.

The Snowy Tree-Cricket (**Oecanthus niveus**) and the Red-necked Cane Borer (**Agrilus ruficollis**) are two common pests of raspberries and the latter also of blackberries in Minnesota. The injury caused by these two insects is readily seen in the winter time or, better yet, in the early spring when the raspberries are putting out their leaves.

The Snowy Tree-Cricket is a delicate, greenish-white cricket which, during the summer, lives among the foliage of various trees and shrubs. The male insect has wing covers with oblique thickenings or ribs which form part of the musical apparatus of the insect. The call of these Tree-Crickets is somewhat similar to that of the Katydid but not quite so harsh. They are heard during the early evening and night, when theirs is probably the most noticeable of all the insect music in Minnesota. The female insect does not have an arrangement for producing music and the wing covers are wrapped closely around the body, being therefore a much narrower insect than the male. Both the young and the adults feed almost entirely upon various green flies and other small insects and although they may occasionally nibble a bit of the foliage of the plant, they must be regarded, in these stages, as beneficial insects. When the female is about to lay her eggs, she punctures with her ovipositor the cane of raspberries and various woody weeds, even in some cases the tender twigs of fruit trees. In each puncture, she places an elongate egg in the pith of the plant. The punctures are close together in one long row, making a long, ragged wound in the stem of the plant, as is shown in the figure. If this twig is split lengthwise, the light-yellowish or straw-colored eggs will be found in the pith. This injury to the raspberry cane is frequently sufficient to cause it to split and break usually resulting in the death of the cane.

In the early spring, just before the canes begin to put out their leaves or even at the time that they are forcing their leaves, these injured canes can readily be picked out and cut off. These should be burned to destroy the eggs, thus preventing the injury being produced a second season. If only a few canes are injured, they may be neglected, inasmuch as the young insects and also the adults are beneficial.

The Red-necked Cane Borer is a small beetle about a quarter of an inch in length. The wing covers are brownish black, with a bronzy luster, while the thorax or "neck" is a coppery red. The eggs are laid by the beetle either on the stalk or on the leaf about the month of June. The larva which hatches from this egg enters the bark at the axle of the leaf, eating around the stem under the surface of the bark in a long, spiral tunnel. This girdling of the bark produces a gall which appears about August. (See figure.) When the larva has girdled the bark, it bores into the stem and lives in the pith. After entering the pith, it usually works up the stem for as much as six inches above the gall while some cases have been noticed where the distance traveled was much greater than six inches. The larva remains in these burrows over winter, finally transforming into the pupa about April or May, emerging as an adult in May or June. The treatment for this pest is similar to that recommended for the Snowy Tree-Cricket. The canes should be cut off well below the gall and these stems burned. If there are wild raspberries in the vicinity, the pruning of infested canes should be extended to these as, otherwise, the beetles emerging from these canes would cause injury in the cultivated varieties. It is necessary to burn the canes in both cases, merely leaving them lying on the ground will be of no benefit, as the insects would be able to emerge from these canes. If the careful examination of raspberry canes is conducted every spring, these two pests can readily be controlled.

WILLIAM MOORE,
Chief of Section of Truck Crop and Greenhouse Insects.

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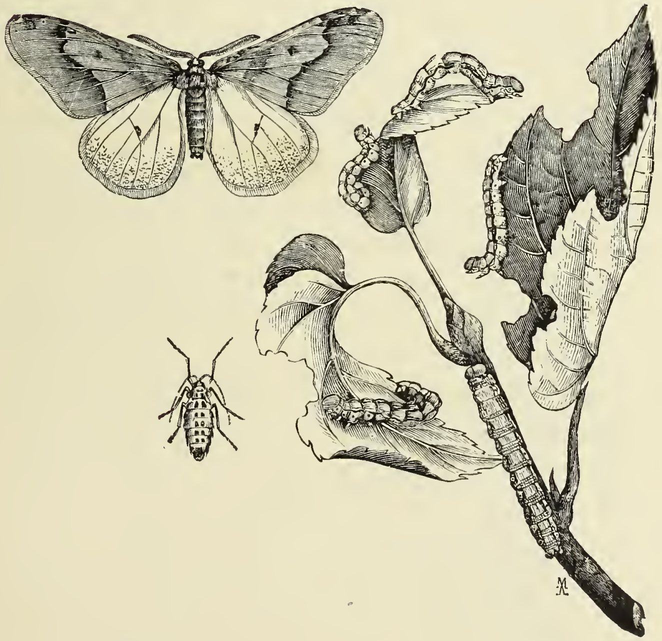
OFFICE OF
STATE ENTOMOLOGIST
ST. ANTHONY PARK, MINN.

CIRCULAR NO. 30
JUNE 15, 1914

SOME TREE-DESTROYING INSECTS



Fall Cankerworm.
Male moth at upper left side. Female moth (no wings) lower left side.
"Loopers" on leaves and twig.

~~Illinois State Laboratory of Natural History~~
Library

LETTER OF TRANSMITTAL.

Minnesota Experiment Station,
St. Anthony Park, Minn.,
June 15, 1914.

His Excellency,
A. O. EBERHART.

Dear Sir:—I have the honor to transmit herewith the manuscript of a paper entitled "Some Tree-destroying Insects," by Professor A. G. Ruggles, of the Division of Entomology of the Minnesota Experiment Station.

The increasing injury to our shade and fruit trees from insect attack makes the information contained herein valuable to all of our citizens. I, therefore, respectfully recommend its publication as Circular No. 30, of the State Entomologist's Department, which, by law, is under your supervision.

Respectfully yours,
F. L. WASHBURN,
State Entomologist.

Approved:
A. O. EBERHART,
Governor of Minnesota.

SOME TREE-DESTROYING INSECTS.

It is estimated that insects destroy $100,000,000 worth of timber in the United States every year. This amount does not include the insect injury done to shade trees, the loss in many such cases being beyond computation. Trees, at any time in the growing season, are subject to insect injury. Some forms attack the leaves, others small limbs, and some of the most insidious work, unseen, beneath the bark in the trunk and in the root. The insects that work on the leaves require, usually, only one year for the life cycle. Sometimes several generations are produced in a season by a single leaf-eating form. Those insects which work beneath the bark, however, usually require two or even more years to complete their transformations.

On shade trees, the leaf-eating forms are practically easy to destroy,—the ordinary arsenical insecticides being very efficacious. Under forest conditions, on the other hand, they are extremely difficult to eradicate. A case in point is the larch sawfly. When the larva of this insect attacks a tamarack on the lawn, the leaf-eaters are killed very quickly if we spray the tree with arsenate of lead. In the woods, however where trees are extremely numerous, it is impossible to use any spraying compound. The only thing to be done in such cases is to assist nature as far as possible in rearing predaceous and parisitic enemies.

The bark borers are hard to eradicate under any condition but particularly so on shade trees. When they have once attacked a shade tree, practically nothing can be done to save that particular tree. In forests, however, under proper management, bark borers may be kept in control by a proper utilization of the infected timber.

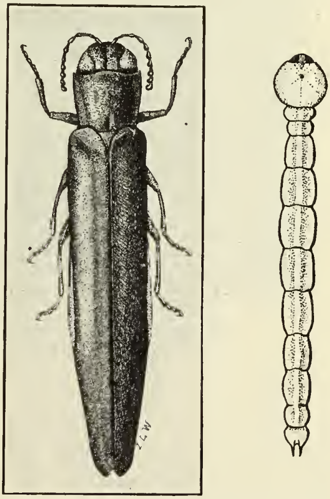


Fig. 1. Grub and adult of two-lined chestnut borer. Enlarged four times.

Among the many leaf-eating forms that are plentiful in Minnesota, are: the fall web worm, the fall canker worm, tent caterpillars, handmaid moth caterpillars, white-marked tussock caterpillars, larch sawfly grubs, and the grubs of poplar beetles.

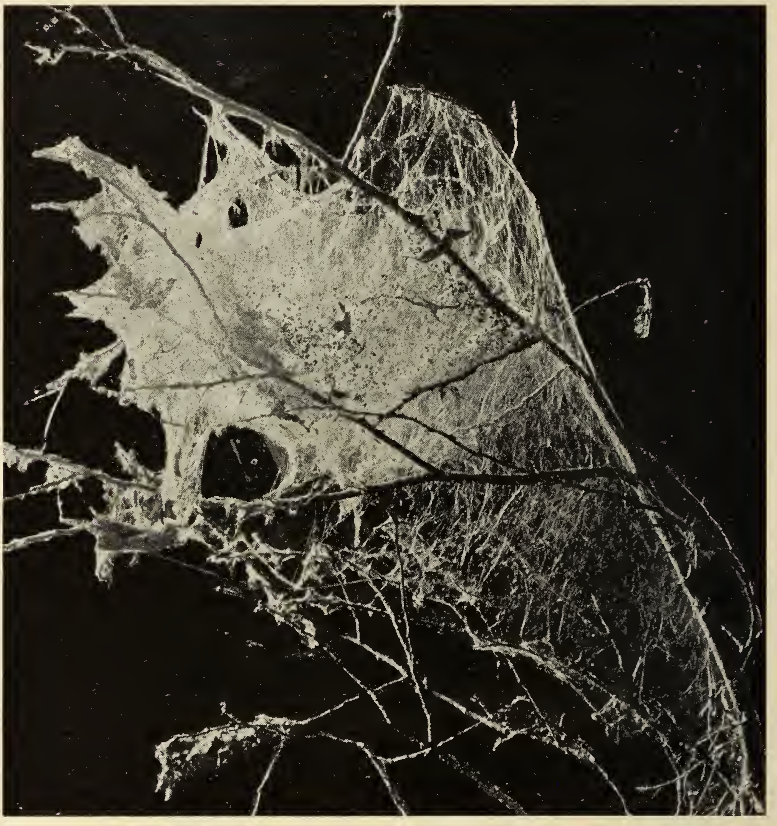


Fig. 2. The tent of the fall web-worm.

No general statement can be made concerning the life cycles of these forms. For example, the first six mentioned have only one generation during the season, while the poplar beetle has several. The first five go through the winter in the egg stage. The larch sawfly hibernates as a larva in its cocoon in the ground, while the poplar beetle hibernates as an adult in the ground under stones and rubbish.

For any of these leaf-eaters, while they are working, a spray of arsenate of lead, at the rate of three pounds of the arsenate of lead paste to fifty gallons of water is advised. Some accurate knowledge of the life history of the species often shows a vulnerable point at which the insect can be combated with means other than spraying. For instance, in the case of the fall web worm and the tent caterpillars, the fact that at certain periods of the day, the caterpillars are sure to be found within the web can be taken advantage of, and during that time, the webs can be cut out with their quota of worms and destroyed.

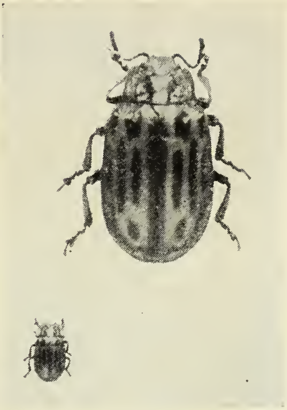


Fig. 3. Adult poplar beetle, Enlarged and natural size.

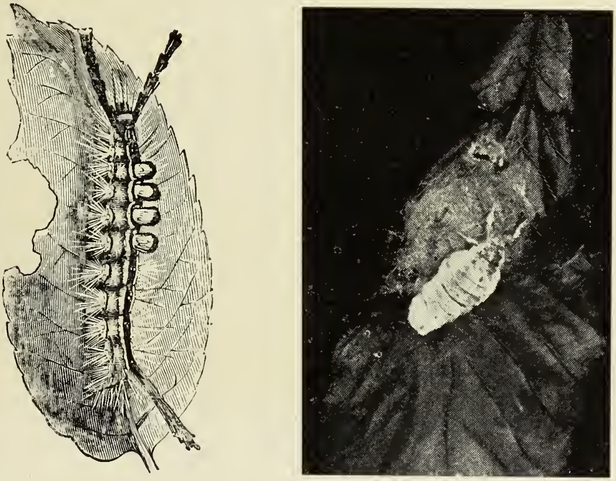


Fig. 4. Larva of tussock moth and wingless female laying eggs on cocoon.

The fact that the handmaid moths gather in large masses at certain periods may also be taken advantage of. The white-marked tussock moth in late summer produces a very conspicuous mass of eggs which do not hatch until the next spring. These eggs may be easily picked off and destroyed during the dormant season, thus preventing the ravages from the forms that would hatch from these the following spring. In the case of the tent caterpillar, the eggs are laid in a ring around the small twigs which make them very conspicuous. These also may readily be detected in the fall or early in the spring, cut out, and burned. A very important phase in the life history of the fall canker worm can be readily taken advantage of. The adults of these "loopers" or "measuring worms" are moths. Moths appear rather late in the fall, sometimes in October, proceed to lay eggs on the trunk and branches of the trees in which stage they pass the winter, and then die. The transformation from "looper" or larva to moth always takes place in the soil and the eggs are always laid by the moth on the limbs of such trees as basswoods, or elms. The female moth is wingless, hence if the tree to be protected has its trunk banded with a sticky material like tree-tanglefoot or tar, thousands of these female moths will be caught and, consequently, no eggs will be laid above the band. Banding in the spring will also prevent the caterpillars wandering from infected to non-infected trees.

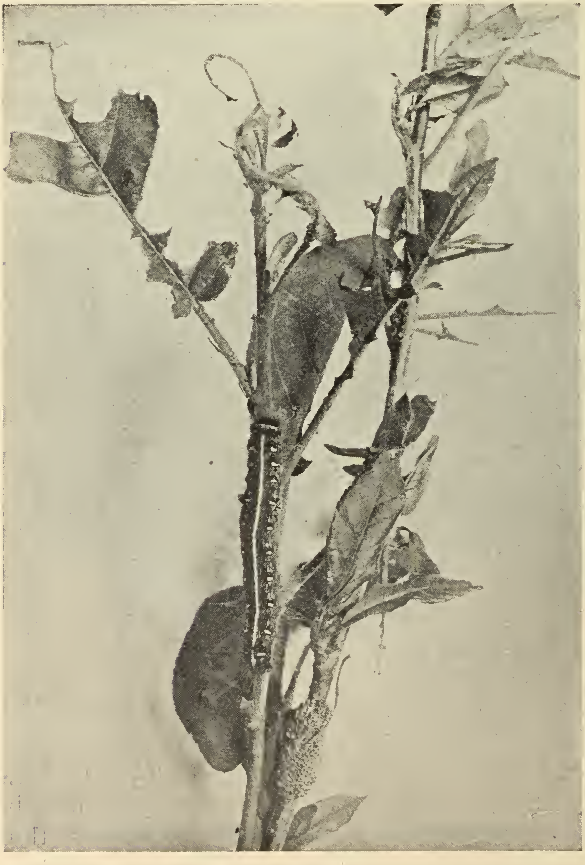


Fig. 5. Full grown larva and egg mass of the tent caterpillars.

Another class of aerial insects includes those which feed upon the leaves and branches of the tree by inserting the beak beneath the surface and sucking out the sap. Among these may be mentioned the different forms of scale insects, such as the cottony maple scale and oyster-shell bark louse. This group also includes the leaf hoppers, tree hoppers, and plant lice. The scale insects are usually rather hard to combat on account of the scaly covering or armor which protects the insects from any spray that one may use against them. To kill such forms during the growing season, the spray would have to be strong enough to injure the foliage, hence, during this time, all one can do is to keep the young insects from wandering over the tree too promiscuously. For instance, the eggs of the oyster-shell bark louse pass the winter under the old scale of the mother insect. These eggs hatch in the spring, and for a few hours, the young wander around before settling down on the bark. At this time, if a spray of weak lime sulphur or kerosene emulsion or some good contact insecticide is used, thousands of these small forms will be killed. The same sprays will prove effective when applied to the cottony maple scale which hibernates on the small twigs and branches. If a thorough spraying is given with the dormant lime sulphur early in the spring ninety per cent probably or more of these insects will be killed. When the leaves are off the tree, the spraying can be much more thoroughly done.

In the case of the leaf hoppers and the plant lice, we again have to resort to a contact insecticide. These insects must be touched to kill them and we find, particularly for the plant lice or "greenfly" that there are several sprays that will readily control them. Among these may be mentioned tobacco extracts, such as black Leaf No. 40, nicofume and nicoticide. Whale oil soap added to this at the rate of one pound to ten gallons will make the solution still more valuable.

Of the forms that bore under the bark and within the wood, the following are the most important found in Minnesota: the two-lined chestnut borer, the bronze birch-borer, and the elm-borer. To this class belong those insects which give the most trouble to the owners of trees. The work is all done out of sight, beneath the bark, and almost the first notice one has of any injury is the dying of the trees.

The adults of all these forms are beetles. They fly, commonly, during the months of May and June, even in July in the case of some species, and during this period, eggs are laid by the mature beetle on the bark in crevices or wounds of trees. These eggs hatch into little grubs which bore beneath the surface, usually working in the growing layer, between the wood and the bark. The burrows made by these grubs usually extend across the grain, and hence, when in sufficient numbers, the tree is actually girdled. The injury can be detected in time for treatment in only one case out of a hundred. In that case the infected area may be cut out and the wound treated with some antiseptic, like pure white lead and linseed oil. In the other ninety-nine cases, the trees will die. The next thing to do, then, is to cut down these trees and destroy them before the borers mature, that is before May. This prevents an attack from the maturing beetles on the healthy trees in the immediate neighborhood. Treating some of these trees with a spray such as iron sulphide will often prevent the beetles laying the eggs where the spray has been placed.

There are some forms of borers, like the coniferous bark beetles and the hickory bark-borer, the adults of which bore directly into the bark to the wood. Here a burrow is made, usually lengthwise of the tree, and along this burrow little excavations are made in which eggs are placed. These eggs hatch into grubs which burrow out usually at right angles from the main burrow. These secondary burrows are made between the wood and the bark. Here again, if the insects are in sufficient numbers, the tree is girdled. The most of these forms are particularly attracted to the coniferous trees. So far as we know, nothing can be done to stop the ravages of such pests. Under forest conditions, the proper utilization of the timber will control the insect.

Of the other boring forms of insects, we might mention the oak twig-pruner. This form is very abundant in Minnesota. The adult insect is a beetle which lays the egg in the twig. The grub hatching from the egg burrows in the woody part of the stem. Finally, the twig is cut nearly off and the wind blows the twig and its inmate to the ground. Here the insect goes through its further transformations. The obvious method of combating, therefore, is to pick up the fallen pruned twigs and destroy them immediately.

From these facts it will be seen that insects play a very important part in determining whether a tree shall be healthy or not. The owner of trees must be continually on the watch to prevent the depredations of these pests. The old adage, "An ounce of prevention is worth a pound of cure," is well illustrated by the warfare that man must maintain against the insect enemies that invade his forest and shade trees.

A. G. RUGGLES,
Head of Section of Spraying and Tree Insects.

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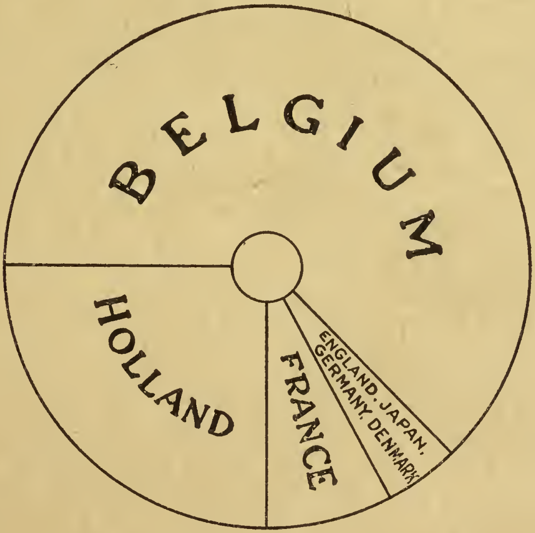
OFFICE OF
STATE ENTOMOLOGIST
ST. ANTHONY PARK, MINN.

CIRCULAR No. 31
NOV. 15, 1914

INSPECTION OF MINNESOTA NURSERIES AND IMPORTED STOCK
1913-1914



Two hundred thousand plants were imported into Minnesota and inspected between Dec. 1, 1913 and Dec. 1, 1914. The above diagram represents the proportionate amount from each country indicated.

Illinois State Natural History Survey
Library

LETTER OF TRANSMITTAL.

Minnesota Experiment Station,
St. Anthony Park, Minn.,
Nov. 15, 1914.

His Excellency,
A. O. EBERHART.

Dear Sir: I have the honor to transmit herewith the manuscript of "The Report upon State Nursery and Orchard Inspection for the Years 1913 and 1914" and respectfully recommend its publication as Circular No. 31, of the State Entomologist's Department, which, by law, is under your supervision.

Respectfully yours,
F. L. WASHBURN,
State Entomologist.

Approved:
A. O. EBERHART,
Governor of Minnesota.

REPORT ON INSPECTION OF MINNESOTA NURSERIES AND OF IMPORTED NURSERY STOCK AND ORNAMENTALS 1913-1914*

F. L. WASHBURN.

The nursery industry of Minnesota is rapidly assuming proportions which places the State amongst the front ranks as a producer in this line. The nurseries of the State represent now one of our large industries, rapidly increasing in size, due to the increasing prosperity and the growing civic spirit of our citizens. The increase in the amount of work involved in inspection has been most striking. In 1903, only 25 certificates were issued; in 1913, we issued 101 certificates, and in 1914, the number has increased to 117, 51 more than were issued in 1912. The total area in Minnesota devoted to the growing of nursery stock approximately totals 3,000 acres, represented by about 130 nurseries. It is to be noted that all of these do not receive certificates. They are all inspected, but some do not ship, and therefore we save them the $5.00 fee by not issuing certificate.

In view of the above mentioned facts, and the splendid stock and large assortment of varieties of hardy fruit trees, shade and ornamental, grown by our Minnesota nurserymen, it would seem not amiss to urge our citizens to plant Minnesota grown stock.

The increase in importation of foreign stock and the consequent inspection of same, have kept pace with that of domestic inspection. In 1913 we inspected 439 cases, representing about 10,000 azaleas, 3,500 roses, 2,500 hydrangeas, 235 palms, and enough other miscellaneous and ornamental shrubs to total approximately 100,000 plants. Bulbs we do not inspect, as the labor involved would require an enormous outlay of both money and time, and the few pests at all likely to be introduced, for the most part already exist in this country.

Under the conditions of a law enacted by Congress, the importer, when foreign stock is received at the port of entry, is obliged to notify the inspector in the State to which the consignment is to be shipped, stating probable date of shipment to the ultimate consignee. Upon receipt of this notice, or an equivalent notice from the Federal Quarantine Board, the Entomologist notifies the consignee in Minnesota, requesting him to advise this office of the date of the probable receipt of said stock, or that he notify us immediately upon its arrival, so that it may be inspected at once. Under the Federal law the secretary of the Horticultural Board at Washington also receives a notice of each consignment and he mails a Federal notice to the Entomologist in duplicate. Thus we are enabled to check up all shipments, and after stock is inspected here, the original Federal blank is filled out and sent to Washington.

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* Also printed as Circular No. 31.

It is necessary that Minnesota work in coordination with the Federal government, and largely with that intent, the new State law, a copy of which we print herewith, was passed and became effective in 1913. The State Entomologist regards this State law in a purely impersonal way. He is simply the instrument for carrying out its provisions and is not at liberty to make exceptions or disregard its instructions. He is not in the slightest degree responsible for its effect upon any individual, or individuals. At the same time he believes that all interested will unite in saying that it is on the whole a good law, and necessary to prevent spread of pests from place to place within the state, and the introduction of any pests into the state. Occasionally it is possible the law, as worded, works a hardship, but on the whole, we are, or should be, willing to make some sacrifice for the common good, and the public at large cannot always be best served without embarrassment to some individuals—fortunately only a comparative few. All nurserymen, as well as the Entomologist, desire to see Minnesota's standard, in the line of nursery stock, upheld, and none of us want to see the introduction into the state of the Gypsy or Brown-tailed Moth, the Elm-leaf Beetle, the San Jose Scale, or the White Pine Blister Rust and other destructive plant diseases. Further, a good system of inspection is a guarantee to other states that Minnesota puts reliable stock on the market.

With a limited number of assistants, at times in fact reduced to one man, and frequently with several large shipments arriving simultaneously from Europe, it is sometimes impossible to respond to all telephone calls, requests by mail, and telegrams from different firms asking us to "come immediately, stock must be unpacked." When this emergency arises, although the law definitely states that shipments from abroad shall not be unpacked before the arrival of the inspector, we sometimes, in order to prevent the plants spoiling, allow florists and nurserymen to unpack consignments with the understanding that plants (shrubs or vines) and containers as well, must remain in greenhouse or packing shed until the arrival of the inspector, and we further request that the labels must be left intact on boxes in order that we may check up with notice from Washington, and that all packing material in said boxes must be immediately burned. Consignees understand that permission to do this must be secured from the State Entomologist **in each case,** since it is a courtesy extended to insure the safety of the plants. Any one presuming that it can be done at any time without the above permission is liable to prosecution and fine, as provided for in the State Law.

In this connection it is an interesting fact that up to this date (November 10, 1914) consignments of azaleas have been arriving from Belgium in the usual number, in spite of the terrible conditions which must have prevailed there this fall, at the time of packing. We have already examined about 16,000 azaleas from that country. One consignment was sent from a Belgian town near Ghent, and upon the Belgian certificate appeared the inspection date of September 15th. Another Belgian inspection was made September 24th; shipments being made, of course, subsequent to those dates. We have also been notified of the arrival of shipments from Holland consisting of hydrangeas, roses, begonias, etc.

Mr. A. J. Spangler was our chief inspector in the field during 1913 and rendered excellent service. His work evidenced a high degree of efficiency, and his experience in this line, before he came to Minnesota, was such as to make his work here a real help, not only to the inspection force but to the nurserymen with whom he came in contact. During the season of 1914 he has been away on leave, and his place has been filled temporarily by Mr. G. W. Peake, also an efficient and acceptable worker in this field of activity.

Condition of Minnesota Nurseries and Certificates Granted in 1913:

The season was, on the whole, a favorable one for tree growth, and for the most part, all nurseries appeared to be in good condition. During the summer there was considerable rainfall, causing a rank growth of weeds and calling for assiduous cultivation on the part of those who would keep their nurseries clean.

The most abundant and injurious insects were the apple leafhopper, *Empoasca mali,* the striped poplar beetle, *Melasoma scripta,* and the apple aphis. According to Mr. Spangler's record on field work, the apple leaf-hoppers were very abundant and in many cases severely checked the growth of large blocks of apple trees. This pest has been always with us. One nurseryman who had been very much troubled with the leaf-hopper had been in the habit of propagating from an old scion block severely infested by this insect, but is now starting a new orchard from which scions will be cut in the future. (NOTE: In the fall the apple leaf-hopper lays its eggs in the new twigs and branches of the apple, and scions being made from these, the pests are carried to new fields. F. L. W.)

The increasing acreage devoted to the growth of poplar and willow cuttings has apparently had a similar effect on the number and severity of attack of the striped poplar beetle. This insect is now present in every nursery growing its host plant. It is a voracious feeder and if the trees are not sprayed upon its first appearance, becomes hard to control.

Of plant diseases, the most injurious and most prevalent was crown gall. We also found anthracnose on raspberry, and Mr. Spangler reported leaf rust on poplar and ash.

Quoting again from his report on field work: "Crown gall is present in a greater or less degree in every nursery. The effect of this disease on the growth of apples in the nursery row, is not always marked and the only way to ascertain its presence is to dig or pull up the trees. This, at best, is an unsatisfactory and unscientific procedure. An inspection at the time the trees are dug in the fall or packed in the spring is the only scientific method. However, such an examination would be prohibitive considering the number of nurseries. and until it can be shown that the disease is more decidedly injurious to the apple, the present policy of warning the nurserymen to cull out the affected trees when dug, would seem the best solution of this problem." It is believed, although crown gall may not affect the apple injuriously, that the soil where crown gall stock of any kind is grown, is so thoroughly inoculated with this disease, that any stock whatever subject to galls planted thereon, either with the affected stock standing in close vicinity or planted immediately following the removal of the diseased stock, would be seriously affected. For example, it is probable that nursery rows of apples planted between the trees of a young orchard infested with crown gall, would become in turn seriously affected.

In the case of raspberries, however, this being a plant of rapid growth, crown gall is very injurious, and is so recognized. An infestation of 20% is considered a sufficient cause for ordering the removal of plants so affected. In one nursery it was known to destroy all of one variety, and in several cases when young plants were badly affected, they were allowed to stand for this season (1913) for fruiting purposes only. Anthracnose on raspberries was found in injurious amounts in two nurseries. The varieties susceptible to this disease are propagated by tip-layering and if the parent cases are removed, the disease seldom becomes serious.

Leaf rust of poplar and ash trees and the tar spot on maple seem very general in the older and larger nurseries, but since this disease exists on the native trees, their presence in the nursery row is not surprising.

MINNESOTA INSPECTED NURSERIES.
1913.

Certificate Number	Nursery	Town	Date of Expiration 1914
552	The Albert Lea Nursery Co C. M. Peterson	Albert Lea	July 27
579	The Minnesota State Nursery E. C. Eaker	Albert Lea	July 27
553	The South Side Nursery Martin Fridholm	Albert Lea	July 27
563	The Wedge Nursery Clarence and Robert Wedge	Albert Lea	Aug. 15
584	The Askov Nursery Ludvig Mosback	Askov	Sept. 16
554	The Turtle Creek Nursery J. M. Lindsay	Austin	July 29
555	The Austin Nursery C. F. Woodle	Austin	July 29
523	The Battle Lake Nursery A. A. DeSmidt	Battle Lake	July 3
524	The Itasca Park Region Nursery Co L. P. Anderson	Bemidji	July 12
573	The Byron Nursery F. E. Cutting	Byron	Aug. 28
519	Oslund's Nursery N. N. Oslund	Cambridge	Oct. 1
539	Sivert's Nursery Peter Sivert	Canby	July 20
580	The Fillmore County Nursery Geo. F. Snyder	Canton	Sept. 8
529	The North Star Farms J. W. Beckman	Cokato	July 17
530	The Wright County Nursery Co John Eklof	Cokato	July 17
531	The Cokato Berry Farm A. L. and F. Lee	Cokato	July 17
506	The Redpath Nursery Thomas Redpath	Crystal Bay	June 12
536	The Flyen Nursery Henry Flyen	Dawson	July 22

510	The Deephaven Nursery Alfred O. Hawkins	Deephaven	June 12
571	The Deerfield Nursery J. F. Brady	Deerfield	Aug. 27
11	(Dealers) The Duluth Floral Co	Duluth	Sept. 19
525	East Grand Forks Nursery Oscar Wick	E. Grand Forks	July 17
509	Old Fashioned Flower Garden Mrs. M. S. Sawyer	Excelsior	June 14
503	A. Brackett	Excelsior	April 28
547	The Amber Lake Nursery P. C. Christenson	Fairmont	July 24
548	McKisson's Fairmont Nursery G. D. McKisson	Fairmont	July 24
1	(Dealers) Royal Nursery Co Fred Ward	Fairmont	Aug. 17
546	The St. John's Nursery Co B. E. St. John	Fairmont	July 23
577	The Faribault Nursery Co A. M. Brand & Co.	Faribault	Aug. 17
569	The Farmers' Seed and Nursery Co Wm. Kueker	Faribault	Aug. 26
589	The Andrews Nursery Co John P. Andrews	Faribault	Aug. 27
522	The H. Koppe Nursery Hugo Koppe	Fergus Falls	June 28
501	The Mills Lake Nursery L. D. Mills	Garden City	July 27
585	The Lake View Nursery Victor Carlson	Grayling	Sept. 21
594	Hiawatha Gardens Nursery Hiawatha Gardens Co.	Hamel	June 25
527	Hugart & Sons Nursery Co H. F. Hugart	Hamel	July 15
528	Howard Lake and Victor Nurseries W. H. Eddy	Howard Lake	July 15
537	Christensen's Nursery P. Christensen	Hutchinson	July 24
544	Harry Arp	Jackson	July 22
538	Dewain Cook	Jeffers	Oct. 7
559	The Kenyon Nursery J. A. Mogren & Son	Kenyon	Aug. 1
558	The Oak Grove Nursery P. H. Volstad	Kenyon	Aug. 1
586	Ayers Jack Pine Nursery H. B. Ayers	Kimberly	Sept. 22
534	Kenyon's Riverside Nurseries J. M. Kenyon	Lamberton	July 21
565	The Jewell Nursery Co J. M. Underwood	Lake City	Aug. 20
567	The National Nursery Co J. F. Anderson	Lake City	Aug. 21
564	The Sugar Loaf Valley Nursery Co Moseman Bros.	Lake City	Aug. 21
3	(Dealers) The Johnson Nursery P. G. Johnson	Lake City	Aug. 21
568	Tolleson's Nursery Co G. A. Tolleson and A. V. Wickstrom	Lake City	Aug. 21
581	The Mayfield Nurseries L. L. May & Co., St. Paul	Lakeland	Sept. 9
590	The Oak Valley Fruit Farms H. W. Harrison	LeRoy	Aug. 30

513	Chisago Lake Nursery Ludwig Carlson	Lindstrom	June 24
521	Morrison County Nursery C. Kelly & Sons	Little Falls	July 27
526	Minnetonka Nursery J. D. Winter	Long Lake	May 26
505	The Tong Nursery Geo. Tong	Long Lake	May 26
543	The Luverne Nursery C. E. Older	Luverne	July 18
533	The Madison Nursery M. Scholt	Madison	July 19
541	The Mankato Nursery L. Z. Smith	Mankato	July 16
2	(Dealers) M. M. Sinotte	Mankato	Sept. 9
572	The Dodge County Nursery W. E. Fryer	Mantorville	Aug. 28
520	The Orton Park Nursery C. J. Orton	Marietta	June 22
570	The Medford Nursery C. C. Patten	Medford	Aug. 27
571	The Deerfield Nursery Co C. H. Brady	Medford	Aug. 27
517	H. F. Baker 4629 Lake Harriet Boulevard	Minneapolis	June 21
591	Farmer's Nursery and Fruit Farm E. A. Farmer	Minneapolis	Oct. 1
508	The Franklin Nursery A. B. Franklin	Minneapolis	June 18
576	Charles Hawkinson	Minneapolis	June 14
575	C. C. Hunter & Co	Minneapolis	June 18
4	(Dealers) The Minneapolis Nursery A. Norlander	Minneapolis	Sept. 12
8	(Dealers) Northrup King & Co	Minneapolis	Oct. 14
592	The Ritchell Berry Farm W. Ritchell	Minneapolis	Sept. 12
512	The Rose Hill Nursery John Hawkins	Minneapolis	June 17
3	P. G. Johnson	Mpls. (Lake City)	Aug. 21
511	Vine Grove Nursery Co A. M. Shepard & Son	Minneapolis	June 17
532	Tiegland's Nursery J. L. Tiegland	Minneota	July 19
504	G. R. Widger	Monticello	April 30
6	(Dealers) The New Ulm Greenhouses Chris Boock	New Ulm	July 15
540	The Pioneer Nursery Wm. Pfaender	New Ulm	July 15
560	The Northfield Seed and Nursery Co J. M. Punderson	Northfield	Aug. 9
518	Dunsmore Nursery Henry Dunsmore	Olivia	June 28
566	Clinton Falls Nursery Co T. M. Cashman	Owatonna	Aug. 13
561	The Mitchell Nursery Co D. M. Mitchell	Owatonna	Aug. 14
562	The Owatonna Nursery Co L. S. Wesely	Owatonna	Aug. 14
516	The Elmwood Select Nursery Frank Brown & Son	Paynesville	June 28
583	O. J. Graham	Pine City	Sept. 16

10	(Dealers) Plainview Nursery R. W. Chapman	Plainview	Aug. 2
556	The Preston Nursery C. E. Snyder	Preston	July 30
587	J. V. Bailey's Nursery J. V. Bailey	Red Rock	Sept. 30
574	The Vinegar Hill Nursery Wm. Sandrock	Rushford	Sept. 2
535	The Sacred Heart Nursery J T. Flagstad & Son	Sacred Heart	July 22
542	John Hill	St. James	July 17
514	The Park Nursery Holm & Olson	St. Paul	June 26
578	Hoyt Nursery Co B. T. Hoyt	St. Paul	June 13
581	L. L. May & Co	St. P. (Lakeland)	Sept. 9
9	The Minnesota Northern Nursery Co. J. E. and E. C. Killmer	St. Paul	Oct. 27
588	The Nicollet County Nursery C. E. Swanson	St. Peter	July 10
545	L. Meininger	Sherburn	July 23
507	The Ferodowill Nurseries F. X. Ferodowill	Spring Park	July 19
515	The Fairview Nurseries Frank Berry	Stillwater	June 26
582	G. W. Strand	Taylor's Falls	Sept. 15
7	(Dealers) The Tyler Nursery J. P. Ericksen	Tyler	Oct. 4
507	F. X. Ferodowill	Wayzata	June 19
510	The Deephaven Nursery A. C. Hawkins	Wayzata	June 12
576	Charles Hawkinson	Wayzata	June 14
557	The West Concord Nursery F. J. Cowles	West Concord	Aug. 1
550	S. D. Richardson Nursery	Winnebago City	July 24
549	Winnebago Nursery John Van Blair	Winnebago City	July 24
502	The University Fruit Farm Nursery State of Minnesota	Zumbra Heights	April 12

A summary of the moneys collected as fees for the Nursery Inspections as provided by Sections 1 and 7 of the Nursery Inspection Act is as follows:

July 3, 1913	State Treasurer's Receipt No. 874	$ 98.00
July 31, 1913	State Treasurer's Receipt No. 981	120.00
Aug. 6, 1913	State Treasurer's Receipt No. 993	55.00
Aug. 6, 1913	State Treasurer's Receipt No. 1909	228.00
Nov. 29, 1913	Cash on hand	5.00
		$506.00

89 Nursery Inspection Fees....$5.00	$445.00
8 Special Inspection Fees.... 5.00	40.00
2 Inspection Fees (affidavits not yet filed) $5.00	10.00
2 Inspection Fees due 1912, paid 1913	11.00
	$506.00

The new law requiring all fees collected to be turned into the State Treasury, did not become effective until August, 1913, and hence all money collected in 1913 previous to that time ($454.99) were credited by the State Auditor to the Entomologist's fund and used in carrying on the work. The total receipts from certificates of inspection in 1913 were $506.00. We hold State Treasurer's receipts Nos. 874, 981, 993 and 1909 for $501.00, which was turned into the State, $464.99 of this being credited to the State Entomologist fund as before stated. One $5.00 fee was received too late to be listed in 1913, and was credited on the 1914 account.

Legislation in 1913.

In the early part of the Legislative session of 1913, a new nursery and orchard inspection law was passed, making inspection compulsory, establishing a flat fee of $5.00 for each certificate granted, and articulating with the provisions of the new Federal quarantine laws. A copy of the State law is here appended.

STATE OF MINNESOTA

Chapter 206, Session Laws of 1913

AN ACT PROVIDING FOR THE INSPECTION OF NURSERIES AND ORCHARDS.

Be It Enacted by the Legislature of the State of Minnesota:

Section 1. **State Entomologist Designated Inspector of Nurseries—Fees—Powers and Duties.**—That the State Entomologist is hereby designated as State Inspector of nurseries and is authorized, either himself or by deputies duly appointed by him, to inspect all premises in Minnesota where nursery stock is grown or held for sale, and further to inspect all orchards or any premises whatsoever within the State, where he has reason to suspect the presence of injurious insects or injurious and contagious plant diseases. Nursery stock shall be regarded as including all field-grown plants (except herbaceous annuals) of any kind, also trees, field-grown shrubs, vines, cuttings, buds, grafts and scions. For this purpose he or his deputy or deputies shall have free access to any field, ground, packing ground, buildings, cellars and other places where the carrying out of the provisions of this act shall make necessary. The State Inspector of Nurseries is empowered and required to grant certificates upon request to such nurseries as he may find free from injurious insects and contagious plant diseases. Such certificates shall be good for one year unless revoked by him. This inspection of nurseries shall take place between May 1st and September 30th, and at such other times as may be necessary to comply with the provisions of this act. Nurserymen or others having stock to inspect shall make application to the State Nursery Inspector for the inspection of stock as far as practicable on or before May 1st of each year. It shall be the duty of the inspector or his deputy to make the inspection as soon thereafter as possible.

For inspection of nurseries a fee of $5.00 per annum shall be paid at time of inspection or before certificate is granted. If a dangerous insect pest or plant disease is found by the inspector on the premises above described and if in his judgment such pest or disease can be eradicated he may direct the owner or his representative in writing what means shall be employed; in case any trees, shrubs or plants are so infested that treatment would be ineffectual he may direct the owner or his representative to have them destroyed. Said order shall be issued in writing. If the order be not obeyed within ten days after service thereof, the State Inspector shall cause the work to be done and render to the owner or persons in charge an itemized bill of the cost; and if such cost shall not be paid within sixty days thereafter the bill shall be reported to the County Attorney who shall forthwith collect same in a civil action in the name of the state and shall turn same over to the State Treasurer to be credited to the inspection fund.

Sec. 2. **Nursery Stock Brought Into the State Must Be Certified To.**—No person shall bring into the State for sale or use therein or re-shipment any trees, plants, vines, cuttings or buds or other "Nursery Stock" unless it be accompanied by the certificate from the Inspector or other proper official of the State from which it came, that it has been inspected and found free from any of the pests or diseases referred to. Such certificates shall be prima facie evidence of the facts therein stated but the Entomologist may if deemed necessary, inspect such stock and proceed with respect thereto as provided for in Section 1.

Sec. 3. **Copy of Certificate to Be Filed With Minnesota Inspector.**—A copy of the state inspection certificate granted to any firm or firms in any other state, territory, or the district of Columbia, shall be on file with the Minnesota inspector before any such firm or firms shall make shipment of nursery stock to be sold or distributed in the State of Minnesota.

Sec. 4. **Shipments to be Accompanied by Certificates of Inspection.**—All shipments from any point or points in the state of Minnesota to other points within the state must be accompanied by certificate of inspection on each package.

Sec. 5. **Railroad and Express Companies Not to Transport Unless Tagged.**—Railroad and express companies are hereby prohibited from accepting stock not tagged with certificate as above stated (and must promptly notify the shipper. If the shipper does not furnish a certificate, such companies shall report said fact with the name and address of party offering said stock for shipment to the State Inspector).

Sec. 6. **Foreign Stock Must Be Inspected.**—Foreign grown stock imported into Minnesota under the provision of the Federal Quarantine Law is regarded as coming under the definition of nursery stock and must be inspected at points of destination. It shall be unlawful for any party or parties to open any package containing such stock from a foreign country unless the inspector or deputy is present. It shall be the duty of the inspector to be present in person or by deputy when notified at least forty-eight hours in advance of the opening of such package.

Sec. 7. **Dealers and Florists May Obtain Special Certificate.**—Dealers or florists not owning nurseries and shipping by post, freight, express or otherwise may obtain from the State Entomologist a special certificate in order to comply with the Federal and State Laws. Such certificate will be granted only to stock purchased in Minnesota from an inspected nursery or to foreign stock inspected in Minnesota.

Sec. 8. **Penalties.**—Failure to comply with any of the provisions of this act shall be subject to the penalties provided in Section 2389, Chapter 38, Revised Laws of Minnesota, 1905.

Sec. 9. **Annual Report Required.**—The State Inspector shall be required on or before December 1st of each year to submit a report and financial statement to the Governor of the State, covering the year's work.

Sec. 10. **$3,000.00 Appropriated for Expenses.**—For all expenses necessary to carry out the provisions of this act there is hereby appropriated from the State Treasury from money not otherwise appropriated the sum of $3,000.00 annually. All fees collected hereunder shall be paid into the Treasury of the State of Minnesota and added to the State Entomologist's appropriation for combating injurious insects.

Sec. 11. **Certain Sections Repealed.**—Sections 2383 and 2384 of Chapter 38, Revised Laws of Minnesota. 1905, are hereby repealed.

Sec. 12. **Existing Emergency Declared.**—In view of an existing emergency this act is to become a law immediately after its passage and signature by the Governor.

Approved April 8, 1913.

A number of problems have presented themselves to the Entomologist and his deputies in connection with some of the sections of this law. Section 7 refers to the treatment accorded a dealer and, for some time, it was a question as to what constitutes a dealer. The general purpose of the inspection law is to prevent the introduction of dangerous insects or injurious diseases from other states and to also prevent the spreading of same in Minnesota. While dealers in the State are, for the most part, honest and careful as to where they buy their stock, there are some who unquestionably would not hesitate to fill their orders with stock from any source, grown perhaps in the far South, not hardy, possibly diseased, and in consequence many times purchased at a discount. In order to prevent this the above wording of this section was chosen, although it at times works a hardship upon the honest dealer. For example, dealers located near our state line, absolutely upright, are prevented by the terms of this provision, from purchasing stock in adjoining states, while the regular nurserymen who own their own property and propagate their own stock, can buy elsewhere. In meeting with this problem, as to what constitutes a dealer, we discussed this matter with many of our representative nurserymen who generally purchase from 8 to 15% of the stock sold. These men were originally, for the most part, dealers when they began this work, and neither they nor the inspectors are disposed to place any unnecessary restraint or unjust burden upon the men who are now beginning as dealers. Acting largely upon the advice of our representative nurserymen, it has seemed desirable to issue a dealer's certificate to a man who raises less than 50% of the stock sold. Before receiving a certificate, a dealer is obliged to file with the State Entomologist, an affidavit executed before a Notary Public, to the effect that all stock sold would be purchased in Minnesota from a duly inspected nursery, or would be represented by foreign (European or English) stock inspected in Minnesota. In 1913 eight of these certificates were issued to dealers. When we bear in mind that some of these dealers rent only a small plot of ground, or possibly a lot or two in the city, and heel in left-over stock, or perhaps grow a little stock and advertise it as a nursery, this decision of the Inspection Department seems a wise one. The section of the law so construed will be a check upon the spread of dangerous insects and injurious plant diseases in Minnesota, and be an inducement to all dealers to become regular nurserymen as soon as possible.

A criticism upon the law is made by some because a party not in the nursery business cannot ship a bundle of shrubs or trees from any point in the State to another without Certificate of Inspection signed by the State Entomologist attached to the package. This criticism is met with in the case of a citizen, not a nurseryman, desiring to ship stock, by the Entomologist giving a permit upon proper investigation, which permit is accepted by the expressman or at the freight office; or when desirable, stock can be sent to the Experiment Station and inspected there by the Entomologist and then forwarded to the consignee. In such case the shipper or the consignee must bear the expense of carriage coincident with this examination. This feature of the law, and the provision made for it by this office, must appear just to any one who bears in mind that this material, coming from a garden not inspected, might, for all we know, or the owner knows, to the contrary, harbor scale or other injurious insects or plant disease, and if permitted to be taken without inspection to another part of the state, might readily be the cause of spreading a pest or pests within our State border. In a few instances we have permitted private parties shipping a package not intended for trade purposes, to use the certificate of a nurseryman friend. This privilege has been abused, however, and hereafter each and every shipment of this kind must be accompanied by an official permit. In this connection we again remind our citizens that the Federal law is so constituted that no one in Minnesota can ship by parcel post without every and all shipments bearing Certificates of Inspection issued by the State Entomologist. State officials are of course powerless to change the Federal statute.

We find that quite a number of private parties who own gardens make it a point to sell plants, etc. Naturally, these should be inspected and receive a certificate, if entitled to same, for they come under the definition of "nursery," namely "a place where plants, trees, vines, shrubs, etc., are grown for sale."

TWO ENEMIES OF THE NURERYMAN:

San Jose Scale and Crown Gall.

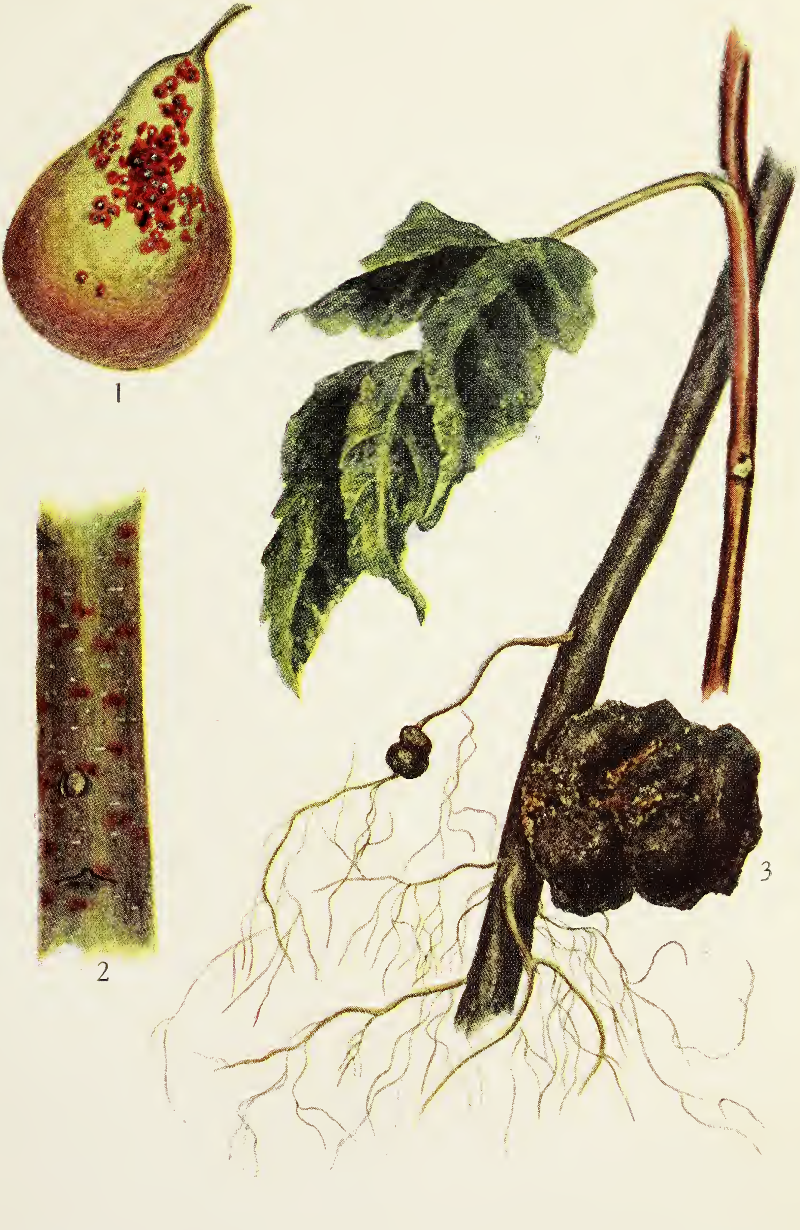
The presence of oyster shell scale on the apple in increasing abundance in Minnesota is of course a menace to the growing of good trees, and the woolly aphis of the apple, apparently on the increase here, would prevent a nurseryman from obtaining a certificate if present upon his trees in sufficiently large numbers.

There are, however, two pests in particular which we have with us: one, an insect not frequently observed here, though presumably more abundant in old orchards than the public is generally aware of, and the other a plant disease of bacterial origin, with us always, and causing the death of thousands of raspberry canes in Minnesota, whatever effect it may or may not have upon the apple.

San Jose Scale:

A fruit tree may be badly infested with oyster shell scale and still survive, but for some physiological reason, let one-half or one-fourth as many San Jose scales infest it and it generally succumbs. This much-dreaded insect has been found by the Inspection force three times in Minnesota nurseries, twice upon stock in two different nurseries, shortly after it had been brought here from another state (Pennsylvania), and recently, in our 1914 inspection, upon mountain ash received from Michigan a few years ago. The female scales upon these latter trees had matured and given birth to young which had infested an adjoining block of young apples. See Figure 1 on colored plate, representing a cutting from one of the apple trees referred to, showing characteristic reddening of the new bark where this scale is attached. Young scales were found crawling about amongst the parent scales, upon the apple and ash trees, even as late as the latter part of August. It is evident that these mature scales must have lived in Minnesota at least two winters, and we have personally, as an experiment, a few years ago, kept San Jose scales alive here, out of doors, on plum and apple for two succeeding winters. It is apparent, therefore, that this scale will endure our climate long enough to do considerable damage.

Our radical treatment of the conditions met with in this infestation of 1914 is referred to elsewhere. By a coincidence, at almost the same time as this discovery in the nursery, the Entomologist purchased from a leading grocer in Minneapolis some Seckle pears which were found badly infested with this same scale. See Figure 2, colored plate. Inquiry developed the fact that these pears also came from Michigan. It has been known, of course, for a long time that this scale existed in Michigan as well as in many other states, and there is nothing particularly threatening to the fruit industry of Minnesota in the fact of this infested fruit being sent here. At the same time, these two findings indicate either an indifference or lack of thoroughness and system, or lack of funds



I. L. WOOD, DEL

BUR. ENGRAVING, MPLS.

TWO ENEMIES OF THE NURSERYMAN

Figs. 1 and 2, San José Scale; Fig. 3, Crown Gall on Raspberry

in the Inspection work in the State referred to. In this connection it is interesting to know that, in 1913, officials in 27 states temporarily withheld certificates because this scale was present.

Crown Gall on Raspberries.

Hardly a nursery in Minnesota is absolutely free from this disease. See Figure 3, colored plate, and also Pl., facing p. 34. From 5% to 80% or over of raspberries were found affected in 1914. Perhaps Loudons are the most susceptible, although no variety appears to be absolutely immune. The disease is characterized by swellings on the root, as shown (and occasionally on the stem). It is also found upon the apple and plum; it is infectious and can be conveyed from cane to apple and vice versa. At one time the finding of a large percent of trees infested with crown gall would disqualify for certification, but with the lack of any proof of permanent injury upon the apple in doubt, as it is now, apparently many inspectors, Minnesota officials included, take but little note of affected apples. They are necessarily strict when the disease is found upon canes, for whatever the effect upon fruit trees, we know absolutely that it greatly weakens and kills raspberry plants, and have found hundreds of these plants in Minnesota dying from this disease. We have urged patrons of nurseries to scrutinize their raspberries, personally, when purchasing. Any consignment which shows even a small percentage of infestation should be rejected. Such exhaustive experiments have been made upon this organism, and so many instances of its infectious nature have been proven, that it seems unnecessary to discuss it. Rotation of crops and the prompt destruction of diseased plants is advised. One nurseryman claims that in planting cuttings he finds that he can, to a large extent, avoid infestation by planting deep at least 5 or 6 inches. This feature has not been made a matter of Station experimentation. It may be undertaken later. In the latitude of St. Paul, diseased plants of bearing age can easily be detected by their scant and drooping, frequently yellowing foliage. Such plants, if pulled, almost invariably show crown gall on roots. However, plants which look healthy above ground, may also occasionally bear gall below the surface. In 1913 inspection officials in 15 states withheld certificates temporarily on account of the presence of this disease in nurseries under their jurisdiction.

INSPECTION IN 1914.

The winter of 1913-14 was rather hard on nursery stock, but our inspectors state that on the whole the stock looks very well this season, some nurseries getting wonderful growth on certain trees.

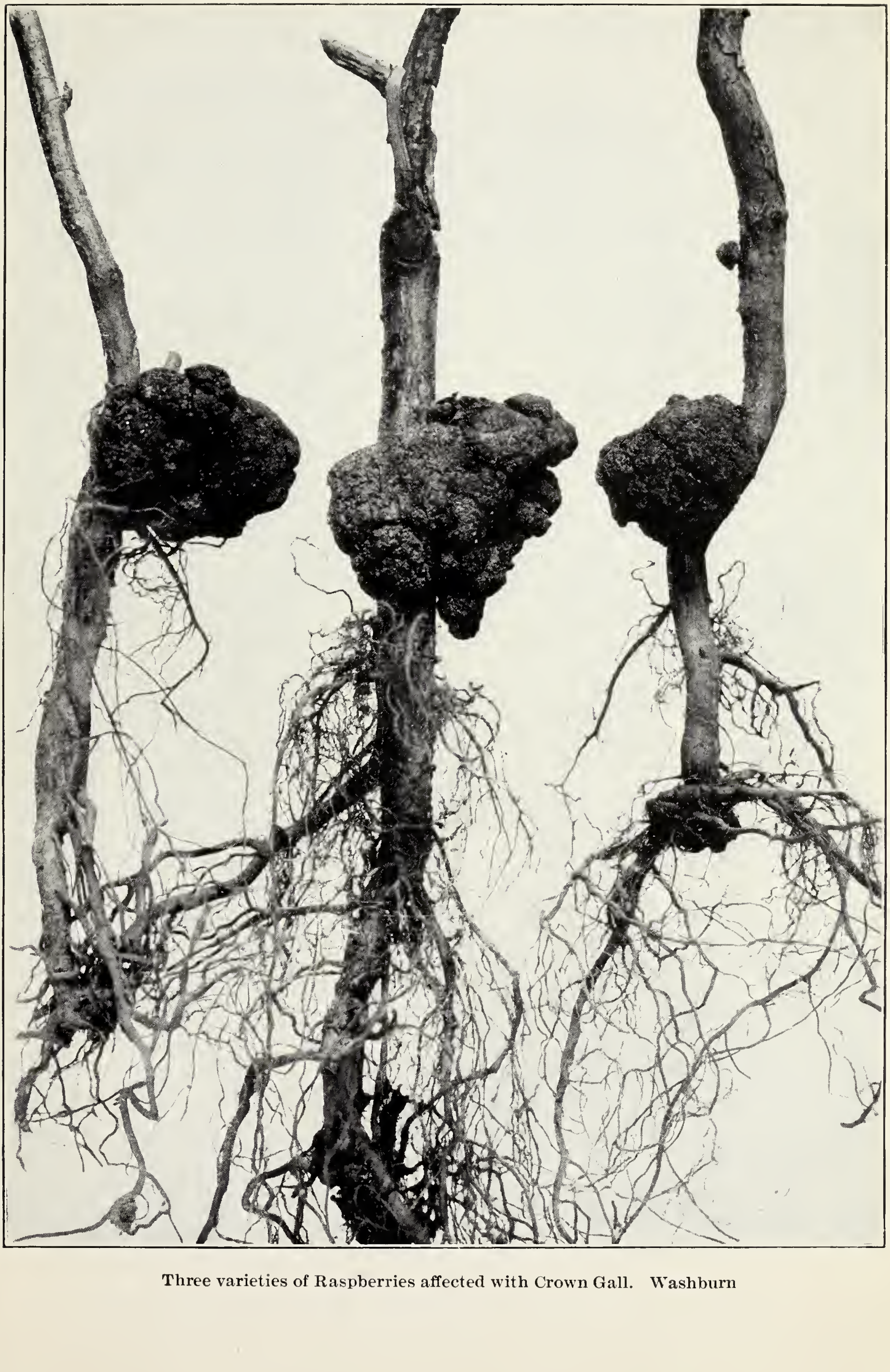
Commenting on the copious rainfall last spring, Mr. Peake in his report states: "The month of June was so wet that clean culture was about impossible, the result of which was that a very bad crop of weeds and much hard work was required for the nurserymen to keep their fields clean. In one or two instances the weeds were so dense as to make thorough inspection almost impossible.

The Inspection Service feels that the nurserymen have done all in their power, with the possible exception of one or two cases, to help the Inspectors in their work, and especially when a pest was discovered, have been quick to co-operate for its eradication."

In connection with the occurrence of scales in some of the nurseries, several kinds of scale insects were found in the various localities and San Jose scale in one particular locality. At this latter place measures were at once taken to stamp out the scale while it was still under comparatively easy control.

The stock coming from this nursery will be as safe to buy as any, for there will be no possibility of live scales being sent from there. Not only has the place been carefully inspected and all infected stock taken care of, but all stock leaving the premises is treated so as to destroy any scales which might slip past the inspectors.

The following insect pests and plant diseases were reported by Mr. Peake upon nursery stock during 1914: Willow aphis, leaf roller on strawberry, snow ball aphis, leaf aphis, soft scales, leaf miners, leaf rollers on box elders, apple aphis, poplar beetles on poplar and willows, cherry slug, plum aphis, woolly aphis on apple, poplar scale, oyster shell on apple, scales on roses, Buffalontree hopper, snowy tree cricket, apple leaf hopper, lilac borer, tent caterpillar, canker worms and others. Also leaf spot on currant, mildew on same; shot hole fungus, especially on young plum; leaf spot on basswood, fire blight on mountain and apple ash; crown gall, black knot, fire blight canker on apple trees, black rust on barberry; plum pocket; anthracnose on blackberry, raspberry, etc.



Three varieties of Raspberries affected with Crown Gall. Washburn

INSPECTED MINNESOTA NURSERIES HOLDING CERTIFICATES OF INSPECTION.

Certificate Number	Name of Nursery	Proprietor or Manager	Town	Date of Expiration
659	The Albert Lea Nursery	C. M. Peterson	Albert Lea	Aug. 26
699	The Minnesota State Nursery	E. C. Eaker	Albert Lea	Aug. 27
660	The South Side Nursery	Martin Fridholm	Albert Lea	Aug. 26
680	The Wedge Nursery	Clarence and Robert Wedge	Albert Lea	Aug. 27
671	Alexandria Fruit and Poultry Farm	W. H. Horton	Alexandria	Sept. 13
648	The Askov Nursery	Ludvig Mosback	Askov	Sept. 8
662	The Austin Nursery Co.	C. F. Woodle	Austin	Aug. 27
661	The Turtle Creek Nursery	J. M. Lindsay	Austin	Aug. 27
618	The Battle Lake Nursery	A. A. DeSmidt	Battle Lake	July 20
625	The Itasca Park Region Nursery	L. P. Anderson	Bemidji	July 6
681	The Byron Nursery	F. E. Cutting	Byron	Sept. 22
682	Oslund's Nursery	N. N. Oslund	Cambridge	Sept. 23
639	Sivert's Nursery	Peter Sivert	Canby	July 19
683	The Fillmore County Nursery	G. F. Snyder	Canton	Sept. 21
626	The Cokato Berry Farm	A. L. and F. Lee	Cokato	July 17
629	The North Star Farms	J. W. Beckman	Cokato	July 17
627	The Wright County Nursery	John Eklof	Cokato	July 17
611	The Vandermark Nursery	C. W. Vandermark	Crookston	May 10
616	The Deephaven Nursery	A. O. Hawkins	Deephaven	June 12
668	The Greysolon Nursery	C. E. Roe	Duluth	Sept. 9
596	The Taylor-Kenney Nursery	Taylor-Kenney Nursery Co.	Eagle Bend	June 1
621	The East Grand Forks Nursery	Oscar Wick	East Grand Forks	July 7
622	The Lake View Nursery and Fruit Farm	P. M. Perry	Excelsior	June 15
678	Minnetonka Old Fashioned Flower Gdn.	Mrs. M. S. Sawyer	Excelsior	June 15
679	The Amber Lake Nursery	P. C. Christensen	Fairmont	Aug. 30
684	McKisson's Fairmont Nursery	G. D. McKisson	Fairmont	Aug. 30
677	The St. John Nursery	B. E. St. John	Fairmont	Aug. 30
685	The Andrews Nursery	John P. Andrews	Faribault	Aug. 21
655	The Brand Nursery	The Brand Nursery Co.	Faribault	Aug. 21
666	The Farmers' Seed and Nursery Co.	Wm. Kueker	Faribault	Aug. 24
619	The H. Koppe Nursery	Hugo Koppe	Fergus Falls	June 29
672	The Wilwerding Nursery	A. J. Wilwerding	Freeport	Sept. 11
700	The Mills Lake Nursery	L. D. Mills	Garden City	Sept. 28
670	The Lake View Nursery	Victor Carlson	Grayling	Sept. 9
614	Hughart's Son's Nursery	Hughart & Sons	Hamel	June 15
628	The Howard Lake and Victor Nurseries	W. H. Eddy	Howard Lake	July 15
646	The Cook Nursery	Dewain Cook	Jeffers	July 22

INSPECTED MINNESOTA NURSERIES HOLDING CERTIFICATES OF INSPECTION.

Certificate Number	Name of Nursery	Proprietor or Manager	Town	Date of Expiration
665	The Kenyon Nursery	J. A. Mogren & Son	Kenyon	Aug. 31
664	The Oak Grove Nursery	P. H. Valstad	Kenyon	Aug. 31
686	The South Kenyon Nursery	E. J. Hershaug	Kenyon	Aug. 31
669	Ayers' Jack Pine Nursery	H. B. Ayers	Kimberly and Aitkin	Sept. 10
630	The Jewell Nursery	J. M. Underwood	Lake City	Aug. 20
633	The National Nursery	J. F. Anderson	Lake City	July 13
632	The Sugar Loaf Valley Nursery	Moseman Bros.	Lake City	July 10
631	The Tolleson Nursery	G. A. Tolleson and A. V. Wickstrom	Lake City	July 8
642	Kenyon's Riverside Nurseries	J. M. Kenyon	Lamberton	July 21
643	The Motter Nursery	J. P. Motter	Lamberton	July 22
687	The Oak Valley Fruit Farms	H. W. Harrison	LeRoy	Sept. 20
688	The Benson Nursery	J. M. Benson	Lindstrom	Sept. 18
689	The Chisago Lake Nursery	Ludwig Carlson	Lindstrom	Sept. 18
602	The Morrison County Nursery	C. Kelly & Sons	Little Falls	July 18
615	The Minnetonka Nursery	Douglas Winter	Long Lake	July 14
613	The Tong Nursery	Geo. Tong	Long Lake	June 14
644	The Luverne Nursery	C. E. Older	Luverne	July 26
637	The Madison Nursery	M. Scholt	Madison	July 16
650	The Mankato Nursery	L. Z. Smith	Mankato	July 28
Dealers No. 16		Neil Neilson	Mankato	July 28
Dealers No. 14		M. M. Sinotte	Mankato	July 20
690	The Dodge County Nursery	W. E. Fryer	Mantorville	Sept. 22
636	The Orton Park Nursery	C. J. Orton	Marietta	July 15
658	The Deerfield Nursery	J. F. Brady	Medford	Aug. 25
657	The Medford Nursery	G. E. Patten	Medford 3	Aug. 25
605	The Baker Nursery	Harry Franklin Baker	Minneapolis	June 21
599	Board of Park Commissioners	Theo. Wirth	Minneapolis	June 24
701	Farmer's Nursery and Fruit Farm	E. A. Farmer	Minneapolis	Oct. 25
597	The Franklin Nursery	A. B. Franklin	Minneapolis	June 15
617	The Gould Perennial Garden	Mrs. E. W. Gould	Minneapolis	July 1
595	The Vine Grove Nursery	A. M. Shepard	Minneapolis	June 17
598	The Hunter Nursery	C. C. Hunter	Minneapolis	June 15
Dealers No. 17		P. G. Johnson	Minneapolis and Lake City	July 12
Dealers 19	The Minneapolis Nursery	A. Norlander	Minneapolis	Oct. 9
Dealers No. 12	Minnesota Ginseng Growers Association	C. R. Klinkenberg	Minneapolis	June 1

Dealers No. 18	Northrup, King & Co.		Minneapolis	June 1
603	The Rose Hill Nursery	John Hawkins	Minneapolis	June 17
640	Tiegland's Nursery	J. L. Tiegland	Minneota	July 19
Dealers No. 11	Cumbercroft Farm and Nursys.	G. E. MacComber	Nemadji	June 1
Dealers No. 15	The New Ulm Greenhouses	Chris. Booch	New Ulm	July 27
649	The Pioneer Nursery	Wm. Pfaender, Jr.	New Ulm	July 27
656	The Northfield Seed and Nursery Co.	J. M. Punderson	Northfield	Aug. 17
634	The Dunsmore Nursery	Henry Dunsmore	Olivia	July 13
652	The Clinton Falls Nursery	Thos. E. Cashman	Owatonna	Aug. 11
654	The Mitchell Nursery	D. M. Mitchell	Owatonna	Aug. 11
653	The Owatonna Nursery	L. J. Wesely	Owatonna	Aug. 11
673	The Elmwood Select Nursery	Frank Brown & Son	Paynesville	Sept. 15
620	The J. H. Bauer Nursery	J. H. Bauer	Perham	June 22
645	The Graham Nursery	O. J. Graham	Pine City	Sept. 8
676	The Preston Nursery	C. E. Snyder	Preston	Sept. 21
674	The Lake Sarah Specialty Farm	F. C. Rkel	Rockford	Sept. 16
694	The Vinegar Hill Nursery	Wm. Sandrock	Rushford	Sept. 21
635	The Sacred Heart Nursery	J. T. Flagstad	Sacred Heart	July 14
Dealers No. 13	St. Cloud Nursery	E. L. Douglas	St. Cloud	July 8
693	The John Hill Nursery Co.	John Hill	St. James	July 23
698	The Andersson Nursery	J. C. B. Andersson	St. Paul	Sept. 30
608	The Bailey Nursery	J. V. Bailey	St. Paul	June 11
607	The Hoyt Nursery	B. T. Hoyt	St. Paul	June 14
667	The Mayfield Nurseries	L. L. May	St. Paul and Lakeland	Aug. 14
604	The Park Nursery	Holm & Olson	St. Paul	June 26
651	The Nicollet & Sibley County Nursery	C. Edwin Swenson	St. Peter	July 29
647	The Meininger Nursery	L. Meininger	Sherburn	July 24
601	The Ferodowill Nurseries	F. X. Ferodowill	Spring Park	June 19
695	The Strand Nursery	G. W. Strand	Taylors Falls	Sept. 17
641	The Tyler Nursery	J. P. Ericksen	Tyler	July 20
675		Grace E. Kimball	Waltham	Sept. 20
616	The Deephaven Nursery	A. O. Hawkins	Wayzata	June 12
623	The Hawkinson Nursery	Charles Hawkinson	Wayzata	June 15
612	The Redpath Nursery	Thos. Redpath	Wayzata	June 15
696	The West Concord Nursery	F. J. Cowles	West Concord	Sept. 20
663	The Winnebago Nursery	John Van Blair	Winnebago City	Aug. 28
697	The S. D. Richardson Nursery	S. D. Richardson	Winnebago City	Aug. 28
610	The Pfeiffer Nursery	C. A. Pfeiffer & Son	Winona	June 10
593	The University Fruit Farm Nursery	State of Minnesota	Zumbra Heights	April 13

INSPECTED MINNESOTA NURSERIES NOT HOLDING CERTIFICATES

1914.

Dealer		Robert H. Black	Albert Lea
Dealer	The Flyen Nursery Co.	Henry Flyen	Dawson
Dealer		P. J. LeBorious	Duluth
Dealers	Duluth Floral Co.		Duluth
Dealer		W. W. Seekins	Duluth
	The Elmore Nursery	Jens J. Coupanger	Elmore
	Birch Lake Ginseng Gardens	Vet Brees	Grey Eagle
		Freeman Thorpe	Hubert
		... Loegren	Long Prairie
		J. S. Harris	La Crescent
		... Woolenwider	La Crescent
		Geo. B. Covey	Medford
		... Ruedlinger	Minneapolis
Dealer	The Plainview Nursery	R. W. Chapman	Plainview
		J. S. Bixby	Richville
Dealers	The Minnesota Nor. Nurs'y.	J. E. and E. C. Killmer	St. Paul
		D. W. C. Ruff	St. Paul
		Paul P. Klevann	Starbuck
	Norway Poplar Forest Grove.	Emil Sahler	Waseca

During the past year, the Inspection Service has inspected 640 containers of foreign stock which has been shipped in from various countries of Europe, especially Belgium, Holland, France, Germany, and England. Of this stock, more than 21,000 plants were roses, over 18,000 azaleas; spirea, 20,000; apple seedlings, 36,000; palms, 1,440; syringas, 1,575; clematis, 651; tree roses, 200; lilacs, 907; rhododendrons, 152; aspisdistra, 1,290; plum stock, 500; acer, 450; coniferous trees, 1,360; citrus, 37; astilbe, 400; aralia, 160; ulm, 225; quercus, 125; araucaria, 900; fruit stock, 200; box pyramids, 50; laurels, 50; philadelphus, 2,427; cornus, 2,710; caragana, 500; rhamnus, 4,140; calycanthus, 200; evergreen shrubs, 1,950; forest and deciduous trees, 11,265; deciduous shrubs, 131,398; field grown floral stock, 4,800; ribes, 5,295; picea, 600; betuda, 6,450; pinus, 10,000; abies, 10,575; chamaccerasus, 4,000; symphoricarpos, 19,200; amelanchier, 1,700; berberis, 8,000; amygdalus, 2,000; corylus, 2,000; deutzia, 500; bay trees, 98; sambucus, 2,350; buckthorn, 10.000; hydrangeas, 1,540; vibernum, 11,000; boxwood, 100; buxus, 500; spruce, 136; sorbus, 8,315.

A summary of the moneys collected as fees for the Nursery Inspections as provided by Sections 1 and 7 of the Nursery Inspection Act is as follows:

Aug. 15, 1914.	State Treasurer's Receipt No. 1518	$240.00
Nov. 19, 1914.	State Treasurer's Receipt No. 1808	320.00
	Cash on hand	10.00
		$570.00
	Cash brought forward	5.00
	3 Inspection fees due 1913, paid 1914	15.00
	101 Nursery Inspection Fees	505.00
	9 Special Inspection Fees	45.00
		$570.00

PROPOSED LEGISLATION AFFECTING STATE ENTOMOLOGIST AND NURSERY INSPECTION.

The State Efficiency Commission recommends that the State Entomologist's duties be transferred from the University to the proposed State Department of Agriculture, which the legislature may create at the next or some subsequent session, upon the ground that it is more fitting that police work, if nursery inspection work can be so regarded, be done by a State Department rather than by the University. It is further proposed that the University co-operate with such official to the extent of performing whatever research work is needed by the State Department, perhaps furnishing some assistance to the inspector when such is needed in the discharge of his duties.

We have every reason to believe that this is a good plan, particularly from the standpoint of the University, which institution should be freed of responsibility of any work representing the discharge of State laws, and we heartily endorse the views of the Commission. It is evident, however, that such an arrangement would be more expensive to the State than inspection is at present. Under the existing plan, where the entire salary of the Entomologist is paid through the University, and where we can have recourse to assistance of properly qualified Agricultural College or Station experts at times when the demands of the work require it, inspection costs the State approximately $4,000 per annum. Under the arrangement suggested, wherein it would be necessary to engage permanent help of a high grade, it would call for at least $12,000 or $14,000 per annum for nursery and orchard inspection alone.

We very much doubt, however willing University authorities might be to co-operate, that when it came to the actual demand for assistance, without clearly defined legal authority for same established, that the request would or could be always granted.

The above figures are conservative and based upon careful study of the work in Minnesota, compared with the following states where the State Entomologist is not connected with University or Experiment Station. Letters of inquiry have brought out the following facts: In Pennsylvania the annual appropriation for Nursery Inspection work is $40,000. They have two permanent research assistants at $1,500 each, and about 25 permanent field assistants, each drawing a salary of $125 per month. The Assistant Entomologist receives $2,000 per annum. The yearly expenses of field and office work of the State Entomologist of Illinois approximate $25,000. (This includes $2,500 for Chinch Bug work.) The State Entomologist's Department of Indiana has on an average 5 permanent field assistants and 3 temporary field assistants, each at a salary of $100 per month, and one office assistant at the same figure. Their annual appropriation for inspection (including bee inspection) is $15,000. Georgia appropriates $38,000 per year for their Entomologist. In that state they have 5 permanent research assistants, one drawing a salary of $2,000, and 4 receiving $1,800 each. They also have 3 office assistants. Ohio spends about $12,000 annually upon this work, having 9 permanent field assistants, one at $1,500, one at $1,400, 4 at $1,200 and 3 at $1,080 per year.

Two matters which would affect Nursery Inspection in all states are being carefully considered by the American Association of Horticultural Inspectors. One is to bring about a standard of phraseology and value of inspection certificates, doing away with the prevailing diversity of wording and meaning, which is frequently both confusing and misleading. The report of the committee appointed to consider this matter will be discussed at the coming meeting of the Association at Philadelphia in December.

The second point under consideration is the adoption by all states of a similar inspection law. This movement also, as well as the first mentioned, is intended to do away with diversity of laws and make all inspection work more uniform. The tentative bill has been practically approved by the American Association of Horticultural Inspectors and endorsed in its main features by the American Association of Nurserymen. It would be impossible to include here the entire wording of the act, and we consequently merely abstract certain provisions the nature of which might provoke discussion on the part of nurserymen. Our personal opinion upon the points cited is expressed in each case.

Section 1. Par. 1. "The term 'nursery' would include any grounds or premises on which nursery stock is being fumigated, packed or stored."

Comment: Since nursery stock is sometimes stored in department stores which sell the same, it is possible that, by free interpretation, department stores might be included.

Par. 2. Defining nurserymen.

Par. 3. Defining nursery stock.

Par. 4. "The term 'dealer' shall be construed to apply to any person, firm or corporation, not growers of nursery stock, who buy nursery stock for the purpose of reselling and reshipping under their own name or title, independently of any control of a nursery."

Comment: We regard this section as too lax, for a dealer might easily be growing a little nursery stock and still be purely a buyer and seller of nursery stock. Our own ruling in Minnesota seems much better; namely, that if a man can show that he raises 50 per cent or more of the stock he sells, we regard him as a nurseryman and entitled to a regular certificate.

Sec. 2. Provides for the creation of a state horticultural inspection board, forming a court of appeal from an inspector's decision.

Comment: Since there would be some delay in getting members of this board together to relieve the distress of some nurseryman who might think he had been wronged, some provision should be made for more prompt settlement than a meeting of the full board.

Sec. 10. "It shall be unlawful for any person, firm or corporation in this state knowingly to permit any dangerous insect or plant diseases, hereby declared to be a public nuisance, to exist on their premises. It shall also be unlawful to offer for sale any infested or infected stock."

Comment: We regard this as a most excellent provision.

Sec. 13. "Nurserymen, dealers, or any person, firm or corporation desiring to sell or ship nursery stock shall make application before July 1st of each year to the State Nursery Inspector for inspection of their stock and any one failing to comply with this section shall be liable for extra charges to cover traveling expenses of the inspector."

Comment: This also we regard as being a most excellent provision.

Sec. 14. Par. 1 has to do with the issuing of a certificate, which certificate sets forth the fact of the inspection and also the number of acres or fractions thereof inspected.

Comment: Some Minnesota nurserymen might possibly object to their acreage being made public.

Sec. 15 provides that all dealers shall secure a dealers' certificate by furnishing a sworn affidavit that they will buy and sell only stock which has been duly inspected and certified to by an official inspector and that he will maintain with the inspector a list of all sources from which he secures his stock.

Comment: We have not this latter provision in Minnesota, but it seems to be a most excellent thing.

Sec. 18 states that it shall be unlawful to willfully misrepresent the character and variety of stock offered for sale or to make a false declaration of acreage or to cause any concealment of stock from inspection.

In the same section, any person, firm or corporation selling nursery stock in the state shall, if requested, furnish the inspector with copies of their order forms, contracts and agreements which are furnished for the use of agents or customers or both.

Sec. 20. "The use of tags or posters bearing an invalid or altered certificate and the misuse of any invalid certificate is prohibited."

Minnesota nurserymen are probably aware of the fact that Canadian authorities have opened a new fumigation station at North Portal, Sask., and that the Canadian importation season was **not** extended from October 7th to October 1st, as at first planned. The Entomologist decided that it would not be desirable to fumigate nursery stock as early as October 1st, accordingly no change has been made in the Canadian regulations.

Field Mice in Nursery and Orchard.

Field mice have caused Minnesota horticulturists enormous losses by the girdling of orchard, nursery and young shade trees. In one season (1902) nursery stock in the vicinity of Rochester, New York, suffered a loss of $100,000 due to the work of field mice. We have no hesitancy in saying that the war of extermination carried on against Hawks, Owls, Crows, Skunks, Foxes, Badgers and Weasels, all of which at times prey upon field mice, is to a large extent responsible for present day losses in this particular.

The extreme fecundity of this pest is emphasized by a published statement of D. E. Lantz, that "a single pair and their progeny in five seasons, would amount to nearly 1,000,000 individuals."

While the clearing up of all rubbish piles which afford places of refuge for these pests, is desirable and helpful, the nurseryman will have to resort to some offensive measures if his trees in orchard and nursery are in a locality likely to be overrun with mice. In the light of our present knowledge, we believe that poisoned grain is the best means of control. One progressive nurseryman claims to have obtained relief in his orchard by placing poisoned wheat in old cans at every other tree. In view of the fact that quail and other grain-eating birds could easily obtain the poisoned material from the open cans, it was suggested that the same bait be placed under boards raised an inch or two from the ground, would be just as attractive, or more attractive, to mice and at the same time prevent birds having access to it.

The Entomologist is testing certain advertised materials claimed to inoculate mice and spread disease amongst them, but sufficient data are not yet available upon which to publish results.

A small area infested with field mice, or houses invaded by them, may be practically freed by the use of the small wooden mouse traps, which sell at the rate of two or three for 5 cents. Smear the pan with bacon and then dust oatmeal over it.

NURSERY INSPECTION FUND.

Cash Account.

AUGUST 1, 1913, TO DECEMBER 1, 1913.*

Cash on hand (Appropriation)		$3,000.00
Assistant Inspector's Salary	$ 625.00	
Clerk and Accountant	150.00	
Expert Assistants, Traveling Expenses, etc	595.62	
Postage	20.00	
Printing	50.25	
Telephone	15.00	
Traveling Expenses of Assistant Inspector	305.57	1,761.57
Balance		$1,238.56

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* NOTE—The above covers only four months work.

Cash Account.

DECEMBER 1, 1913, to DECEMBER 1, 1914.*

Cash on hand	$1,238.56	
Appropriation (Aug. 1, 1914, to Aug. 1, 1915)	3,000.00	$4,238.56
Assistant Inspector's Salary	$1,291.65	
Drawings for Inspector's Report	6.00	
Expert Assistants, Traveling Expenses, etc	475.90	
Express	1.61	
Office Supplies	4.70	
Printing	4.00	
Subscription to National Nurseryman	2.00	
Telephone	5.00	
Traveling and Miscellaneous Expenses of Inspector	36.34	
Traveling Expenses of Assistant Inspector	561.25	2,388.45
Balance		$1,850.11

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* NOTE—Stenographer and clerk paid from State Entomologist Fund; also bills for June, 1914 ($242.15). Eight months expenses, December 1, 1914, to end of fiscal year August 1, 1915, must be met with the balance available.

ABSTRACTS OF INSPECTION LAWS IN VARIOUS STATES.

We include here abstract of inspection laws of all states where inspection is in force, for the benefit of our nurserymen, and suggest that shippers become familiar with the laws of those states into which they propose to ship, thus avoiding delays and possible loss. This list is the latest which has come to our attention, being compiled by officials in New Jersey, and is dated March, 1914. It is therefore probably correct in all essential features.

Alabama. Every nurseryman or dealer in nursery stock doing business in Alabama must take out a license, which is of two kinds: one regular nurseryman and dealer's license and another an agent's license, the agent's license to be obtained only through the principal, who must hold a regular nurseryman's or dealer's license. The fee for each nurseryman's or dealer's license is ten dollars ($10.00). The fee for each agent's license is one dollar ($1.00). All license fees must be paid before the license is granted. A signed copy of the inspection certificate held by the applicant must be filed with the State Horticulturist and money sent to pay for the license and tags needed A tag must be placed on each order delivered. One tag on a box does not cover individual orders therein. No one is allowed to receive a package of nursery stock unless a tag is attached. Printed official tags are furnished at a cost as follows: First one hundred, 65 cents postpaid; first two hundred, $1.00 postpaid; first three hundred, $1.20 postpaid; first five hundred, $1.60 postpaid; in thousand lots, $2.20, sent by express collect. Personal checks will be received. Use money order or draft. Send small amounts in two-cent stamps. It is unlawful for any person, firm or corporation outside of the State of Alabama to ship into the State any citrus stock for propagation or for planting unless said stock is first completely defoliated and fumigated with hydrocyanic acid gas of standard strength. Further, the official inspection tag on such shipment or shipments must state that such citrus stock has been properly defoliated and fumigated. E. P. Sandsten, State Horticulturist, Auburn, Alabama.

Arizona. Nursery stock shipped into the State must be prominently labeled with the name and the address of both the shipper and the consignee, and must be accompanied by a valid certificate of inspection or a copy of such certificate. Shipments into the State, consisting of or containing plants not grown in the locality from which shipment was made, must in addition, specify where such plants were grown. State quarantine orders of interest to nurserymen prohibit: (1) the importation of stock from sections infested by the alfalfa weevil; (2) the importation of citrus, privets, cape jessamine and rubber trees and plants from North and South Carolina and all States bordering on the Gulf of Mexico; (3) rooted grape vines from north of the line of San Bernardino, Kern and San Luis Obispo counties, California; (4) citrus trees from California except from Imperial, Tulare and Fresno counties. All shipments of living plants into the State of Arizona are inspected by Arizona State Inspectors and not delivered until a certificate of release is issued in each case, to the common carrier and to the consignee. If trees or plants are infested or infected with insect pests or plant diseases of general occurrence in the section of the State where the shipment is received, treatment to eradicate, or the separation of the infested or diseased plants or trees, is in most cases permissible; otherwise all plants or trees of the kind found to be infested or diseased are held in quarantine and are shipped from the State or destroyed at the owner's option. Copies of quarantine orders furnished upon application. A. W. Morrill, State Entomologist, Phoenix, Arizona.

Arkansas. Shipments of nursery stock into the State must be accompanied by a copy of the valid certificate of inspection, a copy of the valid permit issued to the nurseryman by the State Entomologist of this State and must bear the name and address of the consignor and consignee with a brief statement of the contents of the shipment; all shipments not so labelled or tagged must be refused for shipment by the carrier. Carriers bringing into the State shipments of nursery stock which originated in foreign countries or foreign possessions of the United States must notify the State Entomologist in writing and must hold such stock at any place designated by him until the same has been duly inspected and released. Nurserymen located out of the State may secure permits by filing with the State Entomologist a copy of their certificate. George G. Becker, State Entomologist, Fayetteville, Arkansas.

California. All horticultural material of every kind is inspected upon arrival. Shipments are held by transportation companies until inspected by State or county inspectors. Each carload, case, box, package, crate, bale or bundle of trees, shrubs, plants, vines, cuttings, grafts, scions, buds, fruit-pits or fruit or vegetables or seed, imported, or brought into this State, shall have plainly and legibly marked thereon in a conspicuous manner and place, the name and address of the shipper, owner or owners, or person forwarding or shipping the same, and also the name of the person, firm or corporation to whom the same is forwarded or shipped, or his or its responsible agents; also the name of the country, State or territory where the contents were grown and a statement of the contents therein. Peach, nectarine or apricot trees, or any trees on peach roots from districts infested with peach yellows or peach rosette, will be refused entry. Notices of all shipments should be sent to the horticultural quarantine officer, Room 11, Ferry Building, San Francisco, California. Frederick Maskew, Chief Deputy Quarantine Office, Room 11, Ferry Building, San Francisco, California.

Colorado. All shipments into the State must bear certificates of inspection and fumigation. All shipments are inspected by county inspectors. Trees with crown gall or hairy root will be condemned and destroyed unless promptly removed from the State. G. P. Gillette, State Entomologist, Fort Collins, Colorado.

Connecticut. All imported stock must not be unpacked without permission from the State Entomologist's office, and all stock entering the State must bear a certificate of inspection. Dr. W. E. Britton, State Entomologist, New Haven, Connecticut.

Delaware. Shipments into the State must bear a certificate of inspection and a statement from the shipper that the stock has been fumigated. Wesley Webb, Inspector of Orchards and Nurseries, Dover, Delaware.

Florida. All shipments of nursery stock into the State without certificates of inspection and fumigation are illegal. All shipments of citrus trees, chinaberry, umbrella trees, cape jessamine, privets, persimmons, green ash, cherry, laurel, virburnum, nudum, pomegranate, allamanda and other plants subject to white fly infestation must have their leaves removed. All outside persons selling nursery stock within the State must pay a fee of five dollars ($5.00), register with the inspector of nursery stock and file a certificate of inspection before receiving permission to sell. All shipments must be securely boxed, or covered to prevent infestation or infection. Dr. E. W. Berger, Inspector of Nursery Stock, Gainesville, Florida.

Georgia. Nurserymen or dealers in nursery stock residing in other States, who desire to ship nursery stock into Georgia, must file with the State Entomologist (Atlanta, Ga.), a copy of their certificate of nursery inspection signed in person by a duly authorized State or Government Entomologist. In addition to the certificate the nurserymen are required to file a signed agreement to the effect that all stock consigned to points in Georgia will be fumigated with hydrocyanic acid gas, in a manner approved by the State Entomologist of Georgia. Upon receipt of the above-mentioned certificate and fumigation agreement the official tag of the Georgia State Board of Entomology is issued to the nurseryman at the cost of printing, as follows: 100 tags, 60 cents postpaid; 200 tags, 85 cents postpaid; 300 tags, $1.10 postpaid; 500 tags, $1.35 sent by express collect; 1,000 tags, $2.00, sent by express collect. All shipments of nursery stock into Georgia must bear a copy of the official Georgia tag, which bears a facsimile of the signature of the Entomologist of Georgia, and also a copy of the certificate issued by the proper official of the State where such shipment originated. Any shipment not so labeled shall be liable to confiscation upon the order of the Entomologist of Georgia. E. L. Worsham, State Entomologist, Atlanta, Georgia.

Idaho. All nursery stock shipped into the State is inspected upon its arrival, the consignee paying for such inspection. Shipments must bear a label showing the name of the shipper, the locality where grown and variety of nursery stock, in addition to a copy of an official certificate of fumigation emanating from the place where the stock was grown. Application to sell stock in the State must be made to the State Board of Horticultural Inspection, a bond of $5,000 filed and annual license secured upon payment of $10.00. Every nursery firm doing business in the State must pay one dollar ($1.00) annually for each agent who represents them. All nursery stock sold or delivered must be true to name and variety as represented. J. U. McPherson, State Horticultural Inspector, Boise, Idaho.

Illinois. Each shipment coming into the State must bear a certificate of nursery inspection. Agents and dealers selling stock obtained from outside nurserymen must file every year with the State Entomologist a sworn statement with certificates showing sources of stock. Dr. S. A. Forbes, State Entomologist; P. A. Glenn, Chief Inspector, Urbana, Illinois.

Indiana. Stock shipped into the State from another State or from one point to another within the State, must be plainly labelled with the name of the consignor and consignee and must bear a certificate of the State or government official showing that the enclosed stock has been inspected and found free from injurious insects and plant diseases. All foreign-grown nursery stock is unpacked and inspected by the State Entomologist upon arrival at its destination in Indiana. C. H. Baldwin, State Entomologist, Indianapolis, Indiana.

Iowa. Duplicate certificates of nursery inspection must be filed with and approved by the State Entomologist. Stock shipped into the State must bear an official certificate of inspection. Prof. H. E. Summers, State Entomologist, Ames, Iowa.

Kansas. A certificate of inspection must accompany every shipment of stock into the State. Prof. George A. Dean, Manhattan, Kansas, and Prof. S. F. Hunter, Lawrence, Kansas.

Kentucky. All packages of stock shipped or delivered in the State must bear a copy of a valid certificate from an official inspector. In addition, each package must bear on the outside a statement of its contents and be plainly labelled with the names of the consignor and consignee. Copies of certificates may be filed with the State Entomologist. Prof. H. Garman, State Entomologist, Lexington, Kentucky.

Louisiana. All stock must be labelled with certificate of inspection, and in addition a copy of such certificate must be filed with the State Board of Agriculture and Immigration. All shipments of orange, lemon, lime, sweet lime, kumquat, Tangerine, grape, fruit trees or other citrus plants shipped into this State must be completely defoliated. All correspondence should be addressed to J. B. Garrett, Entomologist, State Board of Agriculture and Immigration, Baton Rouge, Louisiana.

Maine. All stock coming into the State must bear a certificate of inspection. J. A. Roberts, Commissioner of Agriculture, Augusta, Maine; A. R. Lardner, State Entomologist, Augusta, Maine.

Maryland. Stock shipped into the State must contain a certificate of nursery inspection and the names of the consignor and consignee. All trees are required to be fumigated with hydrocyanic acid gas. A duplicate certificate of inspection must be filed with the State Entomologist. Prof. T. B. Symons, State Entomologist, College Park, Maryland.

Massachusetts. There are no requirements whatever with reference to sending stock into Massachusetts, not even a certificate being needed. All stock, however, received in this State is inspected at its destination, and if its condition requires action of any kind, such as its destruction, return to the consignor, or anything of the sort, this is taken as the result of our inspection, and any shipper sending bad stock into the State does so at his own risk. Dr. H. T. Fernald, Chief Nursery Inspector, Amherst, Mass.

Michigan. Shipments of stock into the State must have attached certificate of inspection. Trees and shrubs subject to the attack of San Jose scale must be fumigated with hydrocyanic acid gas and a statement to this effect, from the nurseryman, should accompany each shipment. Nurseries having agents canvassing for the sale of stock in Michigan are required to take out a license for which the fee is five dollars ($5.00), and in addition file a bond for one thousand dollars ($1,000). Certificates of inspection must be filed with the State Inspector of Nurseries before any stock is shipped into the State. A license is not required for stock sold on mail orders, but a copy of the certificate should be filed and another copy attached to each package shipped into the State. Prof. L. R. Taft, State Inspector of Nurseries, East Lansing, Michigan.

Minnesota. Nursery stock brought into the State must bear an official certificate of inspection. In addition a duplicate certificate of inspection must be filed with the State Entomologist, before shipments of stock are made. Railroad and express companies are prohibited from accepting stock not properly certified. Prof. F. L. Washburn, State Entomologist, St. Anthony Park, Minnesota.

Mississippi. All stock shipped into the State must bear a certificate of nursery inspection and fumigation statement and a copy of such certificate must be filed with the Entomologist in addition to a statement that all stock shipped into Mississippi will be fumigated with hydrocyanic acid gas. R. W. Harned, Entomologist, Agricultural College, Mississippi.

Missouri. Nurserymen shipping stock into this State must apply to the State Inspector for a permit, accompanying the application with a copy of their nursery inspection certificate and an affidavit that no stock will be shipped into Missouri which has not been duly inspected and certified. No fee is charged Agents for outside nurseries must apply for an agent's permit. All shipments entering the State must bear a statement of its contents, name of consignor and of consignee and a certificate of inspection. Prof. Leonard Haseman, Entomologist and Chief Inspector, Columbia, Missouri.

Montana. All stock shipped into the State must be unpacked and inspected and if necessary fumigated. This takes place at the following quarantine stations: Miles City, Billings, Dillon, Missoula, Glendive, Livingston,, Baker, Big Timber, Bozeman, Kalispell, Great Falls, Troy, Plains, Glasgow, Eureka, Helena, Mondak, Havre and Anaconda, or at other points of delivery upon payment of all costs. All persons shipping stock into the State must secure a license for which the fee is ten dollars ($10.00), and file a bond for one thousand dollars ($1,000) with the State Horticulturist. License is good for one year from date of issue. Notice of shipment including an invoice of stock must be sent to the State Horticulturist five days before day of shipment. M. L. Dean, State Horticulturist, Missoula, Montana.

Nebraska. Shipments of nursery stock entering this State must bear a certificate of nursery inspection and be labelled with the name of the consignor and consignee. Prof. Lawrence Bruner, State Entomologist, Lincoln, Nebraska.

Nevada. All nursery stock shipped from other States to points within the State of Nevada, whether fruit trees, ornamental trees, shrubs, vines, cuttings, or other nursery stock of any description whatever must bear on the outside of each car, crate, bale, bundle or package a label giving the name of the consignor and consignee, together with a copy of an inspection certificate of recent date. Such certificate of inspection must certify that said stock has been inspected and found free from insect pests or plant disease of any kind. It must bear the signature of the State Entomologist or Plant Pathologist or other duly qualified person in authority in the State in which said nursery stock was grown. J. E. Stubbs, President, State University, Reno, Nevada.

New Hampshire. Each shipment into the State must contain a certificate of nursery inspection or an affidavit showing that the stock has been properly fumigated with hydrocyanic acid gas. W. C. O'Kane, Acting State Nursery Inspector, Durham, New Hampshire.

New Jersey. The law requires the inspection of all nurseries at least once in each year. Shipments into the State must be accompanied by a certificate of inspection of current date, or copy thereof, attached to each car or parcel, together with a statement from the shipper that the stock therein is a part of the stock inspected, and stating whether such stock has been fumigated with hydrocyanic gas or not. It shall be the duty of all carriers to refuse for transportation within the State, all stock not accompanied by a certificate of inspection. All stock coming into the State may be detained for examination, wherever found, by the State Entomologist or the State Plant Pathologist, and if found to be infested with any insects or plant diseases, injurious or liable to become so, will be destroyed. Dr. T. J. Headlee, State Entomologist, New Brunswick, New Jersey; Dr. Mel. T. Cook, State Plant Pathologist, New Brunswick, New Jersey.

New Mexico. No laws covering transportation of nursery stock. The Territorial Legislature of 1903 provided for county boards of horticultural commissioners, which were given authority to control orchard pests. Prof. Fabian Garcia, Horticulturist, Agriculturist Experiment Station, State College, New Mexico.

New York. Any nursery stock brought into the State must remain unpacked and unopened until permission is given by the Commissioner of Agriculture. All stock is inspected at destination. To facilitate rapid inspection receivers of nursery stock should notify the Department Office at Albany of the receipt of consignments. It would also be well for shippers into the State to notify the Commissioner of Agriculture, giving all names and possible date of arrival. All nursery stock shipped into this State must bear a copy of a certificate of inspection. Calvin J. Huson, Commissioner of Agriculture, Albany, New York.

North Carolina. Stock shipped into the State must bear a certificate of nursery inspection and also a statement that the stock has been fumigated. A duplicate certificate must be filed with the State Entomologist. Franklin Sherman, Jr., Entomologist, State Department of Agriculture, Raleigh, North Carolina.

North Dakota. Nursery stock shipped into the State must bear a certificate of inspection. Every individual, firm or corporation who employs agents or traveling salesmen, or who solicits for the sale of nursery stock in the State, must obtain a license from the Director of the North Dakota Experiment Station, the cost of which is ten dollars ($10.00). In addition a certificate of inspection and a bond for five hundred dollars ($500) must be filed. License is good for one year following date of issue. Director North Dakota Experiment Station, Agricultural College, North Dakota.

Ohio. Shipments of nursery stock entering the State must bear the name of the consignor and consignee, and be accompanied by an official certificate of inspection or fumigation. Agents are required to pay a license fee of one dollar ($1.00) and dealers a license fee of five dollars ($5.00); also to file sworn statements that the stock which they sell or deliver has been officially inspected and was received by them accompanied with a valid certificate of inspection or fumigation. N. E. Shaw, Chief Inspector, Ohio Department of Agriculture, Columbus, Ohio.

Oklahoma. Outside nurserymen desiring to do business in Oklahoma must file in the office of the State Entomologist, prior to shipping, a duplicate copy of the season's inspection certificate, and give such information in regard to their business methods as may be necessary to convince the Oklahoma Entomological Commission that they are conducting their business in a fair and honorable way. Each individual shipment must be accompanied by a tag bearing valid copy of said inspection certificate. Failure to comply with this rule will render shipment subject to confiscation. Benjamin F. Hennessy, Secretary, State Board of Agriculture, Oklahoma City, Oklahoma.

Oregon. All nursery stock shipped into the State is inspected at point of delivery. All nursery stock, shipped into the State, which is affected with crown gall or hairy root will be destroyed or returned. It is unlawful for any person to send or bring into Oregon, peach trees, nectarine trees, apricot trees or trees on peach roots or peach pits from districts where the peach yellows or peach rosette is known to exist. Shippers of nursery stock must mark on each package, in a legible manner, the name and address of shipper, name and address of consignee, the place where the contents were grown, and the fact that the contents are nursery stock, seedlings, or seeds as the case may be. H. H. Williamson, Secretary, State Board of Agriculture, Portland, Oregon.

Pennsylvania. Certificates of fumigation are required to accompany shipments from other States and the word "fumigated" printed or stencilled on or accompanying the certificate of inspection will not be accepted unless it is apparent that such word is a part of the certificate granted by a State Inspection officer. Nurserymen from other States are also required to file affidavits that all nursery stock of kinds subject to infestation by San Jose scale will be properly fumigated before shipment into the State. Blanks furnished upon application. Transportation companies are required to reject all stock entering the State unless certificates of inspection and fumigation are attached. Prof. H. A. Surface, Economic Zoologist; Enos B. Engle, Chief Nursery Inspector, Harrisburg, Pennsylvania.

Rhode Island. All shipments of nursery stock into the State must have attached to each package in a conspicuous place, a copy of the certificate of inspection signed by an official inspection officer. Agents having no nursery, who wish to sell stock within the State must apply to the State Entomologist for an agent's license and must state where they propose to purchase the stock they intend to sell. A. E. Stene, Entomologist, Kingston, Rhode Island.

South Carolina. Stock coming from other States, provinces, or foreign countries and consigned to points within this State, must have attached to every bundle or package an interstate tag or permit issued by the South Carolina State Crop Pest Commission. This interstate tag or permit can be issued only after the certificate of inspection of the State, country or province where shipments originated, has been approved by the South Carolina State Crop Pest Commission and filed in the office of the entomologist or pathologist of the State Crop Pest Commission. It is further required that the fumigation certificate of the South Carolina State Crop Pest Commission be properly filled out and filed in the office of the entomologist or pathologist of the Commission before the interstate tag or permit can be issued, unless the official inspection certificate includes a statement that the nursery is properly equipped for fumigating. Prof. A. F. Conradi, State Entomologist; Prof. H. W. Barre. State Pathologist, Clemson college, South Carolina.

South Dakota. Nurserymen residing outside of South Dakota must file in the office of the State Entomologist a copy of his official inspection certificate and in addition attach to each shipment of stock coming into South Dakota, a copy of his inspection certificate and a statement stating where the stock was grown. Prof. Harry C. Severin, State Entomologist, Brookings, South Dakota.

Tennessee. All shipments of stock into the State must have attached a certificate of inspection and a fumigation tag. Outside nurserymen must file in the office of the State Entomologist, Knoxville, Tennessee, a duplicate certificate of their nursery inspection signed in person by the official in charge, and in addition file in that office an agreement signed by the proprietor of the nursery to thoroughly fumigate with hydrocyanic acid gas all nursery stock subject to San Jose scale and other dangerous insect pests. Prof. G. M. Bentley. State Entomologist and Plant Pathologist, Knoxville, Tennessee.

Texas. Before shipping nursery stock into this State nurserymen must file with the Commissioner of Agriculture a certified copy of their inspection certificate. In addition a fee of five dollars ($5.00) is charged for the issuance of a permit to ship into the State. All shipments must bear a certificate of inspection from the State in which the shipment originated and a tag showing copy of the permit from Texas. Agents are required to procure agents' credentials from their nurseries on a form approved by the Commissioner of Agriculture. Dealers are required to take out the same permit as nurserymen. Greenhouse plants are included in the inspection. Commissioner of Agriculture, Austin, Texas.

Utah. No person can engage in the business of selling or importing nursery stock without having first obtained a license to do business in the State. Any person may obtain a license from the State Horticultural Commission upon the payment of a fee of $2.50 annually and by filing with the State Horticultural Commission a bond in the sum of five hundred dollars ($500). Each salesman or agent must hold a certificate giving his name and the name and address of the persons he represents, together with the license number of his principal. A copy of the certificate of inspection must be attached to each shipment. All nursery stock will be quarantined on arrival and, if deemed necessary, disinfected or destroyed at the cost of the owner. J. Edward Taylor. State Inspector, Salt Lake City, Utah.

Vermont. Nursery stock transported into this State for delivery therein must be accompanied by a certificate of inspection from a duly authorized nursery stock inspector of the State from which the consignment is made and the name and post office address of the consignor and consignee. M. B. Cummings, State Nursery Inspector, Burlington, Vermont.

Virginia. Before shipping stock into this State it is necessary to procure from the Auditor of Public Accounts, Richmond, Virginia, a certificate of registration, the fee for which is twenty dollars ($20.00). Duplicates for agents' use are free. (Send certified check or draft for $20 drawn payable to the Treasurer of Virginia.) In addition outside nurserymen are required to file a duplicate certificate of inspection from their local State Entomologist with the State Entomologist of Virginia, who will furnish tags at cost. One tag must be attached to each package of stock sold in the State. W. J. Schoene, State Entomologist, Blacksburg, Virginia.

Washington. No person, firm or corporation can engage in or continue in the business of selling, as agent or otherwise, within this State, or importing, nursery stock, without first having obtained a license. Application therefor must be made to the Commissioner of Agriculture and a satisfactory bond in the sum of one thousand dollars ($1,000) must be filed with him; each bond must be renewed every year. The license fee for nurserymen and tree dealers is five dollars ($5.00) per annum; for agents one dollar ($1.00). All licenses expire one year from date of issue unless renewed upon the same as originally provided for. Every person licensed to do business in the State must notify the State Commissioner of Agriculture and district inspector of his intention to ship nursery stock, giving the name and address of the consignee. Hon. J. H. Perkins, State Commissioner of Agriculture, Olympia, Washington.

West Virginia. Each shipment of nursery stock into the State must be accompanied with an official certificate of nursery inspection, and in addition, the official permit tag of the State. Tags are issued at cost upon acceptance of the certificate of the shipper, and after the State certificate of registration has been procured. This is issued by the Auditor of State at Charleston, West Virginia, upon payment of a registration fee of five dollars ($5.00) Transportation companies are required to notify the State Entomologist of all shipments of nursery stock entering the State and give the names and address of the consignor and consignee. W. E. Rumsey, State Entomologist, Morgantown, West Virginia.

Wisconsin. All shipments of nursery stock into the State must bear certificates of inspection and certificate tags. Transportation companies are forbidden to deliver nursery stock unless accompanied by certificate tags. Nurserymen or dealers desiring to sell stock in the State must secure a Wisconsin State license by filing a duplicate of their State inspection certificate with the State Inspector and enclosing five dollars ($5.00) to cover cost of license. All nursery agents canvassing in the State must carry an agent's duplicate license, furnished for one dollar ($1.00). Wilful misrepresentation of nursery stock is considered a misdemeanor. Prof. J. G. Sanders, Entomologist and Chief Nursery Inspector, Madison, Wisconsin.

Wyoming. Any person or firm wishing to do business in this State must first obtain a license. Licenses are issued on application for a period terminating on July 1st of the next succeeding inspection year (approximately two years). All applications must be accompanied by the license fee ($25), a bond in the sum of five hundred dollars ($500), conditioned that the principal will faithfully obey the law of the State of Wyoming, and by a certificate of inspection from an authorized inspector in the State from which shipments are to be made. On receipt of these papers, the Secretary of State Board issues authorized shipping tags (at cost). Nursery stock may not enter the State and transportation companies may not deliver unless such tag be attached to each and every box, bundle, or bale. The presence of the shipping tag shall be taken as prima facie evidence of inspection, and no further inspection is required, though the Board reserves the right to re-inspect, if for any cause it may deem it wise to do so. It is the duty of every outside nursery, holding a license to do business in Wyoming, to notify the secretary of the board, as inspector-in-chief, of every considerable shipment of nursery stock that it proposes to send into this State, said notice to reach the secretary at least five days before the delivery of the said goods, and to state the kind of stock included and the probable time of its delivery, the railroad station and the name of the consignee. It is the further duty of each nursery to file with the secretary the full address of every agent or solicitor it may employ in the furtherance of its business in the State. For circular of detailed information, address Mr. Aven Nelson, Secretary of the State Board of Horticulture, Laramie, Wyoming.

Canada. Nursery stock entering Canada must be imported through the following ports, during the periods mentioned, at which places the stock is fumigated:

Vancouver, B. C., from October 1st to May 1st.

Niagara Falls, Ont., from October 1st to May 15th.

Winnipeg, Man., North Portal, Sask., and St. John, N. B., from March 15th to May 15th and from October 7th to December 7th.

Windsor, Ont., and St. Johns, P. Q., from March 15th to May 15th, and from September 26th to December 7th.

No stock can be taken out of bond without a fumigation certificate.

The following stock is exempt from fumigation and may be imported at any time through any port without inspection: (a) Greenhouse grown plants, including roses in foliage which have been grown in pots up to 3 inches in diameter but not larger. **A certificate that the plants have been grown under glass must accompany the invoice and shall be signed by the consignor.** (b) Herbaceous perennials (the stems of which die down in winter), such as peonies, sunflowers, etc. (c) Herbaceous bedding plants, as geraniums, pansies, etc. (d) Bulbs and tubers, such as hyacinths, lilies and dahlias, irises, etc. (e) Cottonwood or Necklace poplar, when shipped from and grown in Dakota or Minnesota. The port by which it is intended that the nursery stock shall enter, must be clearly marked on each package. All persons importing stock, except that which is exempt from fumigation, must notify the Dominion Entomologist.

The importation of all nursery stock through the mail is prohibited. This does not apply to greenhouse-grown florists' stock, cut flowers, herbaceous perennials and bedding plants, which will be admitted provided that a detailed statement of the contents is attached to such parcels. The term nursery stock includes trees, shrubs, plants, vines, grafts, scions, cuttings and buds. Copies of the regulations or additional information can be obtained from Dr. C. Gordon Hewitt, Dominion Entomologist, Ottawa, Canada.

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OFFICE OF
STATE ENTOMOLOGIST
ST. ANTHONY PARK. MINN.

CIRCULAR NO. 34
DEC. 15, 1914

NOV 2 1915

THE CUCUMBER BEETLE

~~Illinois State Natural History Survey~~
Library

LETTER OF TRANSMITTAL.

Minnesota Experiment Station,
St. Anthony Park, Minn.,
December 15, 1914.

His Excellency,
A. O. EBERHART.

Dear Sir: I submit herewith manuscript of a paper entitled "The Cucumber Beetle," by C. A. Sell, working under the direction of Professor William Moore, of the Division of Entomology of the Minnesota Experiment Station. I believe the facts therein stated will be helpful to our market gardeners in Minnesota and respectfully recommend its publication as Circular No. 34, of the State Entomologist's Department.

Respectfully yours,
F. L. WASHBURN,
State Entomologist.

Approved:
A. O. EBERHART,
Governor of Minnesota.

THE CUCUMBER BEETLE

BY C. A. SELL

INTRODUCTORY NOTE.

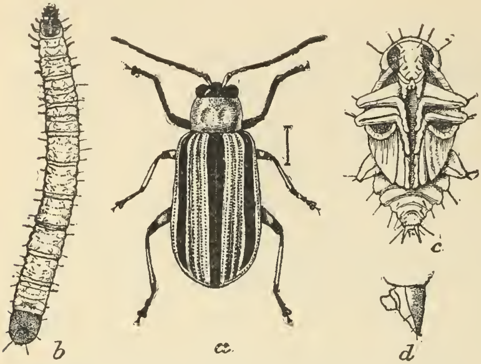
During the past summer, Mr. Sell, a graduate student of the University, wishing to do some work in Economic Entomology at a time when no course was being given, took up a special problem for investigation. As he had but the summer to work, it was suggested that he work out the life history, as far as possible, of the cucumber beetle, which is frequently very injurious to cucumbers grown in cold frames and to try a treatment for the larval stages which was originally suggested by Mr. F. A. Gibbs, a market gardener. The remedy, tobacco extract, has been found to be very efficient and could even be used in a much smaller proportion than originally employed.

We wish to thank Mr. Gibbs for the use of his plants and for aid given during these experiments.

WILLIAM MOORE,
Head of Section of Truck Crop and Greenhouse Insects.

In Minnesota, early cucumbers are raised in cold frames or "out-door hot-beds." Two or three weeks after the glasses are permanently laid aside, cucumber beetles begin to gnaw the leaves. While they seem to prefer leaves that are young and tender when they begin work, they will usually continue to attack a leaf that has been injured in preference to a younger, healthy leaf. As the plants grow very rapidly and the beetles are usually very numerous., this damage can be overlooked. About the middle of June, they begin mating and for about two weeks are more destructive to the plants than they have been earlier in the season. They are so much in evidence and their injury to the plants is so obvious that the farmer is tempted to spray or dust the plants with Paris green or lead arsenate, which is of very little value at this time.

But the feast will not last more than two or three weeks, and the plants will easily withstand the attack which is not waged at a vital part. If the injury becomes too great, air-slaked lime or ashes dusted over the plants will tend to drive the beetles away, and will probably be of as much value at this time as an arsenical spray. The males die first. Soon after the female is fertilized, the male becomes sluggish and dies. In some cases, he hides in the soil to die, while in other cases he may be found just under the leaf upon which he has died.



Cucumber Beetle, adult, pupa and larvae. After Chittenden, Bu. Ent. U. S. Dep. Ag.

The female crawls down the stalk about one and one-half inches below the surface of the soil—just above where the large roots branch off—and deposits her eggs on the stalk. Then she comes out of the ground, mopes around a day or two without eating, and dies.

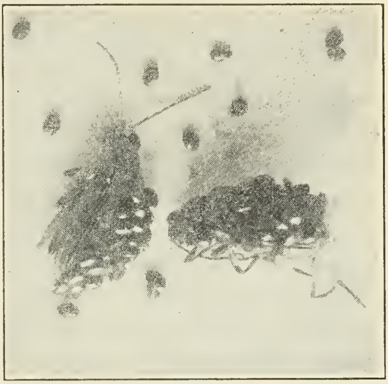
The general color of the recently laid eggs is lemon yellow with very small dots forming a color pattern which becomes less and less distinct as the process of incubation makes the eggs darker. At first the egg is cylindrical, with rounded ends, but it becomes shorter, thicker, and more nearly "egg-shaped" as the germ develops. While the eggs are deposited singly, they are usually found in clusters containing from five to twenty eggs, adhering rather loosely to the root of the plant and to one another. One female lays from forty to eighty eggs.

As soon as the larvae are hatched out, they begin work on the root-stalk of the plant. At first, they are so small and white and wiggly that they appear very much like maggots, but they have true legs, pro-legs, and biting jaws. A larva begins by eating a layer from the outer surface of the stem, and while it may take a fairly wide swath, it keeps the general direction of the vine until it is about four or five inches above the ground. Another may take the layer just under where the first went, and so on until there are eight or even twelve larvae eating from the roots towards the vine, making quite a burrow in the stalk. If unchecked, the larvae will destroy a plant in three days after they appear.

Soon after the larvae appear above the ground, the flat sides of the stalks begin to turn white, then the leaves nearest the roots turn white around the edges, and finally the whole plant begins to wither.

There is but one generation of these beetles a year. The larvae grow very rapidly and pass into the inactive pupa stage. In a few days, the adults appear, and these hibernate beneath piles of rubbish. If everybody would kill off the larvae, which can be successfully done at the proper time, there would not be so many adult beetles to hibernate through the winter.

Gamasid mites, *Uropoda sp.* (determined by Banks), are frequently found in the burrows with the beetle larvae. While investigations are by no means complete, there is a strong probability that the mites feed on the juice that flows so freely from the wounds inflicted by the beetle larvae. Whatever later investigations may disclose, it is certain that nicotine properly applied will kill the mites, as well as the larvae, after which the plants will be thrifty.



Adult Cucumber Beetle covered with mites.—Sell.

When the adult beetles first appear, these mites frequently load themselves upon the wing-covers in such numbers that the beetle is unable to fly—not only because of the extra weight, but also because they exude a sticky substance that plasters the wing-covers together. Female beetles are more likely to be afflicted with the mites than male beetles, but the mites do not destroy the beetle's eggs.

Sometimes a beetle can be found so completely loaded with mites that only a small part of the head, the antennae, and legs protrude from a mass of mites.

By hindering the locomotion of the beetle, the mites may be in some measure indirectly beneficial, though it is doubtful if they interfere with any of the real life processes of the beetle.

Nicotine or tobacco extract is a safe and efficient remedy. Nicofume was used in the experiments upon which this paper is based, but any tobacco extract which contains 40% nicotine will give the same results. Cruder extracts may be used with as good results, but it requires a corrrespondingly larger proportion of such extracts to the gallon of water.

Nicofume Liquid (a concentrated, nicotine solution), is put up in pound cans (a druggist's pound, 12 oz.) which retails for $2.00 each. One teaspoonful of Nicofume to a gallon of water makes the solution strong enough. There is very little danger of injury to the plant, however strong the solution may be applied. One can of 40% nicotine will be sufficient to treat one thousand to eleven hundred hills. Since a man can treat fourteen hundred hills a day, the entire cost of treatment would be about 40 cents per hundred hills—an amount comparatively insignificant when the value of the cucumber is considered.

Look for the larvae on the stalk just at the surface of the soil. They will appear there in one day after they hatch out, as they work very rapidly. When they appear, take Nicofume solution and pour it on carefully with a narrow half-pint cup. Be careful to pour it against all sides of the stalk in such a manner that it will run down the stalk. While the solution will kill the larvae without touching them, the burrows in the stalk may be very deep; the larvae will finally work to the heart and begin on the pith, and the larvae working on one of the under layers may be even or ahead of the ones working on the outside layers, so that a quick splash of the liquid into the burrow would be the surest way. Much depends upon the care in which the liquid is applied. It pays to put a good man on the job. He should stoop down, or better, squat down with the cup of liquid in one hand and the other hand free to move the plant slightly, so that he can carefully examine the exact extent of all the workings above ground. The larvae that escape this treatment are usually in the upper end of the burrow just above the ground.

It is worth while to do the work right. Just pouring the liquid on the hills, or using a sprinkling can will do some good; it is better than letting the insects destroy the plants but it cannot be really successful.

With field cucumbers, the adult beetles begin work as soon as the plants are up. A covering made out of an old barrel hoop cut in two, so as to form two semicircles, covered with some kind of screen or gauze has been successfully used to keep the beetles off the young plants. The treatment of the larvae, will, of course, be identical with the treatment prescribed for cucumbers raised in cold frames.

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No. 35

OFFICE OF
STATE ENTOMOLOGIST
ST. ANTHONY PARK, MINN.

CIRCULAR NO. 35
JAN. 15, 1916

DEC 19 1916

FURTHER OBSERVATIONS ON MINNESOTA BIRDS: THEIR ECONOMIC RELATIONS TO THE AGRICULTURIST.

~~Illinois State Laboratory of Natural History~~
Library

LETTER OF TRANSMITTAL.

Minnesota Experiment Station,
St. Anthony Park,
January 12, 1916.

His Excellency,
J. A. A. BURNQUIST.

Dear Sir: I have the honor to transmit herewith the manuscript entitled "Further Observations on Minnesota Birds: Their Economic Relations to the Agriculturist," and respectfully recommend its publication as Circular No. 35, of the State Entomologist's Department, which, by law, is under your supervision.

Respectfully yours,
F. L. WASHBURN,
State Entomologist.

Approved:
J. A. A. BURNQUIST,
Governor of Minnesota.

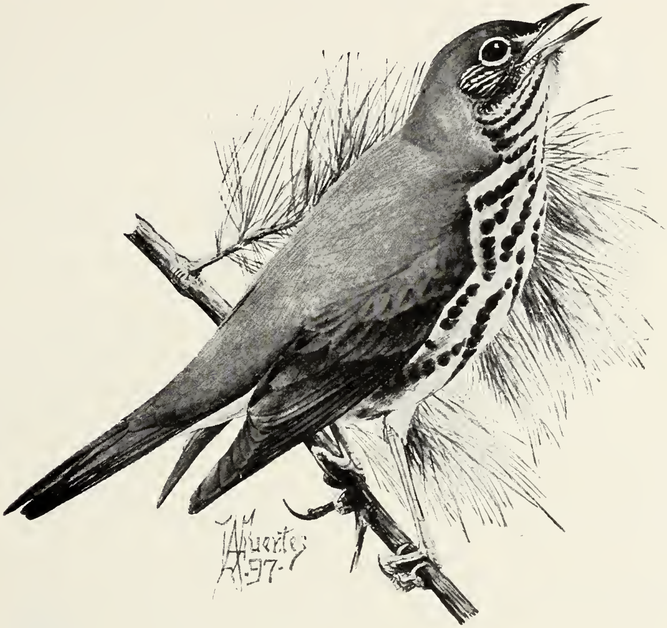
FURTHER OBSERVATIONS ON MINNESOTA BIRDS; THEIR ECONOMIC RELATIONS TO THE AGRICULTURIST.

F. L. WASHBURN.

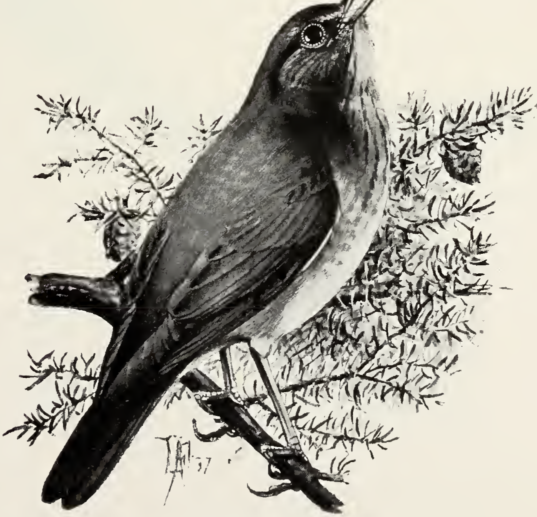
The increasing interest in our birds prompts the Entomologist to add to the information published with colored plates in Circular 32, from this office, by issuing the present leaflet. It is manifestly out of the question to discuss all of our bird residents or visitors, or even to list and figure them in a circular. It has been our aim, therefore, rather, to describe, briefly, different types representing certain groups common in Minnesota. There has been a great demand for Circular 32 on the part of schools and it is hoped that these brief accounts of Minnesota bird life may also be of service.

We are particularly fortunate, through the kindness of the artist, Louis Agassiz Fuertes, of Mabel Osgood Wright, the living author, and the Macmillan Company, publishers of "Citizen Bird," to be able to present here a few of the excellent and accurate illustrations with which that publication is adorned. It is with the greatest pleasure that we acknowledge our appreciation of the courtesy extended by the above.

THE WOOD THRUSH AND WILSON THRUSH.



The distinct, sharply-outlined, large, round, black spots on the white breast and under parts of the Wood Thrush, together with

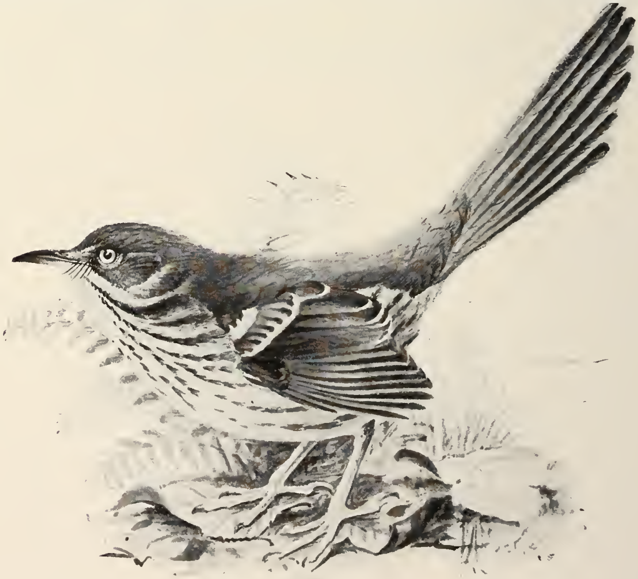


Wilson Thrush

its larger size, will at once distinguish it from the following species—the Wilson Thrush or Veery, with which it vies in the matter of song. In the latter species, the white breast is more or less tinged with cream and dotted with small, somewhat indistinct brownish, wedge-shaped spots. Its upper parts are brownish but not as bright as in the Wood Thrush.

The first-named bird is 8¼ inches long; the latter (Veery) a little over 7 inches. Both lay greenish-blue eggs in a coarse nest modelled somewhat after the nest of the robin, but the nest of the Veery is on or close to the ground. The beautiful song of both of these birds, coming from the dense woods, if once heard, is never forgotten and they are both important insect-eaters; in fact, the entire thrush family, tho occasional members may be attracted to berries and fruit, notably in the case of the robin, must be credited with being benefactors of the farmer and fruit raiser. Forbes, after a somewhat exhaustive examination of their food habits, states that 61% of the food of thrushes consists of insects.

THE BROWN THRUSH OR BROWN THRASHER.



The excellent illustration here given is sufficient to enable us to recognize this very common bird of our thickets and fields. Rufus brown above, with black spots on a white ground below, its colors and conspicuously long tail make it a notable object when it seeks a prominent position on a lofty branch, preparatory to singing. Its song, while striking, will not compare, we believe, with those of the two preceding nor with that of the cat bird. One of its chief charms, perhaps, lies in the fact that it is an accompaniment of the welcome spring weather. We have been so struck by the little rhyme credited to "Olive" in "Citizen Bird," which certainly is very descriptive of its habits and song, that we venture to repeat it here:

"My creamy breast is speckled
(Perhaps you'd call it freckled)
Black and brown.

"My pliant russet tail
Beats like a frantic flail,
Up and down.

"In the top branch of a tree
You may chance to glance at me,
When I sing.

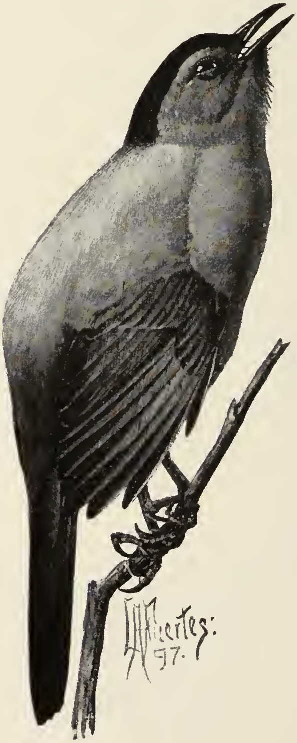
"But I'm very, very shy,
When I silently float by,
On the wing.

"Whew there! Hi there! Such a clatter.
What's the matter—what's the matter?
Really, really?

"Digging, delving, raking, sowing,
Corn is sprouting, corn is growing.
Plant it, plant it!
Gather it, gather it!
Thresh it, thresh it!
Hide it, hide it, do!
(I see it—and you.)
Oh! I'm that famous scratcher,
H-a-r-p-o-r-h-y-n-c-h-u-s r-u-f-u-s—Thrasher
Cloaked in brown."

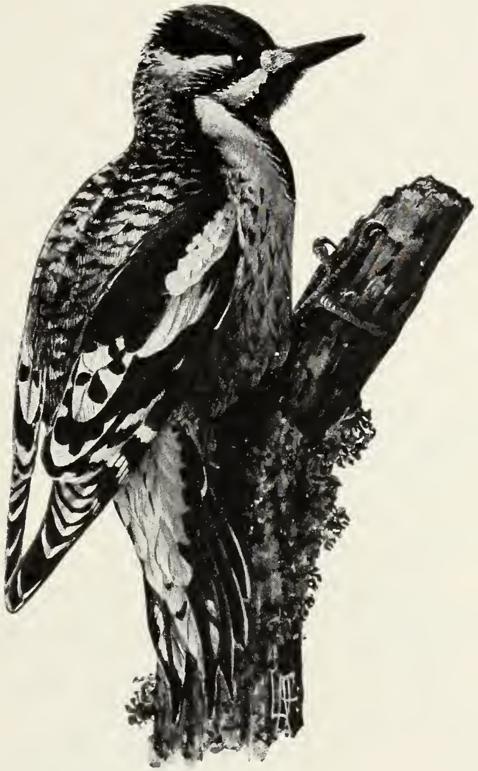
While the brown thrush may take a little fruit or grain, it is a good insect-eater and, as a ground feeder, scratching amongst fallen leaves, it picks up many injurious insects, and it must be admitted, some useful forms as well, the ground bettles, for example.

THE CAT BIRD.



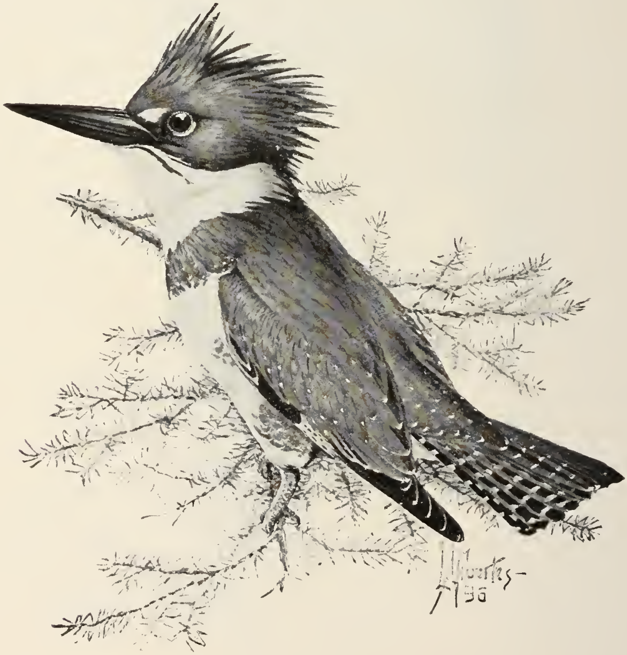
Discussed in Circular 32 of this Department, but the writer has been so forcibly reminded of the beautiful song of this bird by the extremely natural appearance of the drawing, that he is led to include it here as a plea for the bird, upon the ground of its qualities as a songster.

THE YELLOW-BELLIED WOODPECKER OR SAPSUCKER.



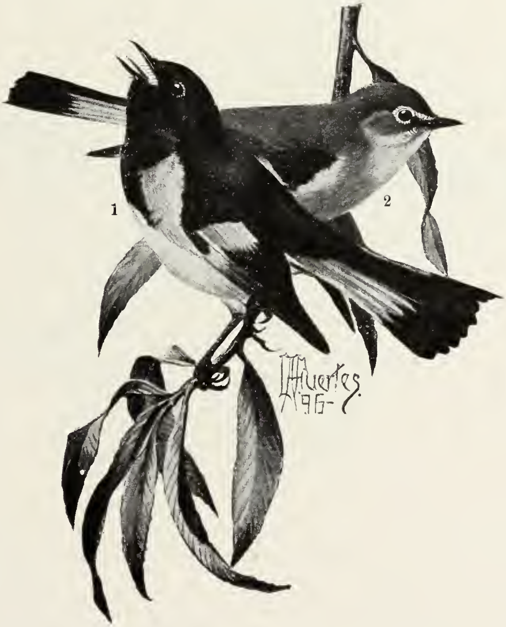
The illustration will prove so helpful in enabling one to distinguish between this injurious form and other woodpeckers which are useful that we add these few words, although the species is briefly discussed in Circular 32. In striking contrast to other birds whose tongues are extensile for extracting borers from infested trees, the tongue of this species has a somewhat "brush-like" tip. It cannot be protruded to any extent, and is thus modified for an entirely different diet from that of other members of the same family. That it seriously injures birches, maples, mountain ash, apple, evergreen, and other trees by girdling them with holes in its seeking for sap and cambium goes without saying. It may and probably does consume a few insects which are attracted to the bleeding holes, but not in sufficient numbers or of the right kind to compensate for the injury inflicted upon the trees. The bird is about 8½ inches long. The adult male has crown and throat red, breast black, and belly a shade of yellow. The female has no red on throat and the red color of the crown is sometimes replaced by black. The downy woodpecker, which is one of our most useful birds, is under 7 inches in length and has a scarlet band on the back of the head in the male—not on the crown. On account of its small size and difference of coloration, it need not be confused with the species under discussion.

THE BELTED KINGFISHER.



The above virile picture gives an excellent idea of the appearance of this vivacious, noisy, and, it must be confessed, at times injurious bird. Naturally a lover of good-bordered streams and ponds, its noisy rattle is a fit accompaniment to the sound of running water and it is here that it takes frequent toll of fish which might otherwise have lived to fill the angler's creel. Fish in ponds and streams, therefore, suffer as a result of its rapacious appetite, but its depredations become of marked importance when it habitually takes its food from ponds or streams of those who raise trout on a commercial scale. Frequently, the shot gun is used by the fish-breeder in self-defense; or taking advantage of the bird's habit of frequenting a perch over the water, whence it can see its prey below the surface, a steel trap is placed on the top of an upright pole planted in the pond and the marauder captured therein. Its white eggs are placed at the end of a long burrow in some bank near the water.

THE AMERICAN REDSTART.



Fuertes' fine drawing illustrates the male (1) and female (2) of this beautiful bird. One of a large group of wood-warblers, examples of which (Blackburnian, Maryland yellow-throat, Chestnut-sided, and Yellow-rumped) were shown in color in Circular 32. The male is striking, not only on account of his brilliant coloring, but also on account of his conspicuousness, since he is extremely active and this activity coupled with the above-mentioned brilliancy of coloring, makes him an object to catch the eye of even an indifferent observer. As if conscious of his beauty (breast, head, and back a deep, lustrous black; long wing-feathers at base a rich, salmon; about half of the outer tail feathers, sides of breast, and body beneath wings deep salmon) he is continually spreading and flirting his tail, extending his wings, and making short flights from the trees seeking insects, much after the manner of our common fly-catchers. The female is much duller-colored, greenish-gray on head and back and yellowish where the male is salmon.

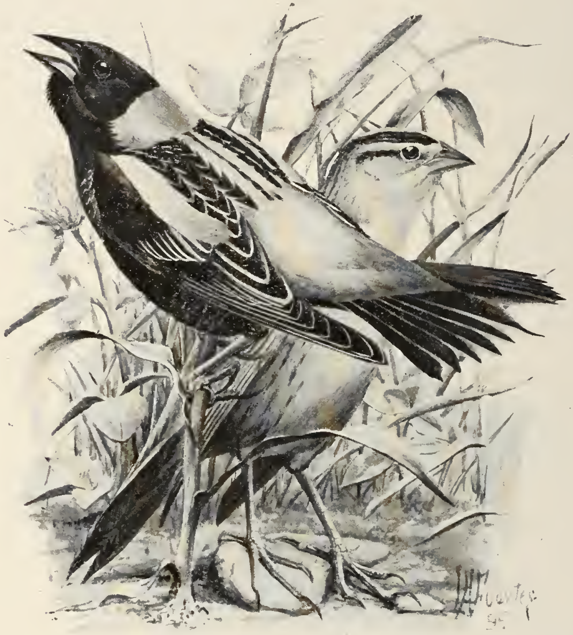
THE GREAT NORTHERN SHRIKE; BUTCHER BIRD.

A misconception regarding this bird prevails among many, a mistake which is encouraged by its name and perhaps added to, unfortunately, by the illustrations frequently seen, showing the bird with a captured sparrow. It is true, however, that he kills sparrows and other small birds, a fact evidently fully appreciated by his intended victims, since a panic among them is caused by his appearance, but he atones for this by killing and devouring field mice, shrews, and injurious insects. It is to his credit, also, that he is a persistent enemy of the English sparrow—a bird responsible for many ills and now recognized as one means of dispersal of the much-dreaded San Jose scale. The great northern shrike is common in our fields until late fall, sometimes as late as December in the latitude of Minneapolis, and even later in the southern part of the state, and recognized by his peculiar flight, close to the ground, by his size and coloration. He is about 10¼ inches long, black, gray, and white. At times, he is something of a songster. Amongst injurious insects captured, we might mention grasshoppers and various caterpillars.

AMERICAN CROSSBILL.

A frequent visitor from the North in the fall and during the winter. More common in the timber and wooded country than in open sections, though occasionally seen on some high tree in the middle of a large city. Wherever observed in this latitude, they are always tame and easily approached. The writer has found them in July in the upper Red River Valley, feeding upon the insect contents of poplar galls. These were probably young birds and their occurrence here at that date would indicate the birds breeding at no very great distance.

THE BOBOLINK.



This dandy amongst birds—a favorite of bird lovers and subject of many a song and poem—is a common and welcome summer resident here, filling the fields with drunken melody, while his more modestly-colored mate is sitting quietly on her nest, well hidden in grass or clover. So familiar to all is this songster that with the above excellent illustration before us, no verbal description is necessary.

The beauty and song of the male bird are but transient qualities, for after the breeding season, he loses his fine clothes, becomes dull olive-colored, streaked with black, like the female and young, and, in the fall, flocks southward to wild rice marshes and cultivated rice fields, wintering in South America. At night one frequently realizes flocks of these birds are passing, by hearing their metallic "*Chink*" in the darkened sky above. As "reed bird" and "rice bird," they find their way into the markets of the East and South, fattened by voracious feeding in the rice fields. While with us in the North, they eat large numbers of injurious insects.

THE RED-WINGED BLACKBIRD.

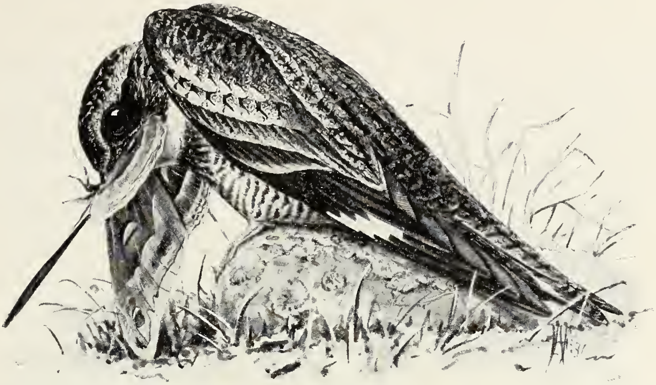
However injurious the group of blackbirds become in late summer and fall, in the spring and early summer they almost or quite pay for their depredations by consuming large numbers of injurious insects. The Red-wing is a welcome arrival in the early spring. Its really melodious note at that time is tuneful comfort to bird lovers, after a long winter devoid of feathered singers. At that time, the position taken by the bird in uttering its characteristic note or notes discloses to advantage its scarlet shoulders well set off by glossy black of wings, body, and tail. The grayish-brown female, streaked with black, we may not notice, but the male compels attention.

The Department of Agriculture has made an exhaustive study of this bird's food habits and finds about ⅞ of its diet consists of harmful insects and weed seeds. Locally when in large flocks, as above intimated, it—with others of its tribe—may be very harmful and a resort, on the part of the farmer, to extreme measures is justified.

THE WHIPPOORWILL AND NIGHT HAWK.

These two birds, sometimes confused by the uninitiated, yet perfectly distinct species, are both insect-eaters and one of them—the Whippoorwill—not often seen and not very well known. It is a bird of the woods, unless disturbed flying only by night, characterized by its peculiar note, oft-repeated: "Whip-poor-will!" "Whip-poor-will!" "Whip-poor-will!" with a "cluck" or "chuck" before each call, audible to one close at hand. This song, quite forceful and penetrating, is heard in the first part of the night and just before dawn. In coloration, the bird harmonizes closely with the wood colors. When flushed, it disappears with absolutely noiseless flight.

The Night Hawk, on the other hand, is markedly a bird of the open, frequently in flight in the afternoon and early in the evening, high in the air, uttering at frequent intervals his rather harsh cry and occasionally, on half-closed wings, darting down to the earth with a booming sound, made, it is claimed, by the rush of air through his primary wing feathers. The two eggs of the Night Hawk are laid on the ground or in the fields, or even on a flat rock, with no semblance of a nest; occasionally, they are found on flat roofs of buildings in cities. The Whippoorwill's eggs, also two in number, are laid on the ground or on a log or stump in the woods, likewise protected by no nest. The coloring and markings of the two birds also serve to distinguish them. The Whippoorwill's colors partake of the browns while the Night Hawk is grayish. The tail of the former has the three outer feathers white for about ⅔ their length. Further, the end of the tail is rounding.



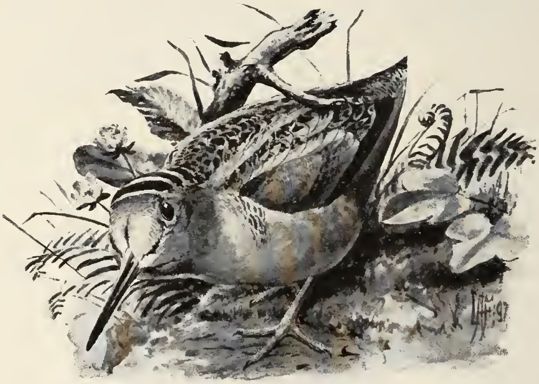
Night Hawk

The latter-named bird has a conspicuous white patch on each wing; its tail is forked. The Whippoorwill feeds largely on moths and beetles; the Night Hawk on May flies, gnats, dragon flies, grasshoppers, etc.

THE QUAIL.

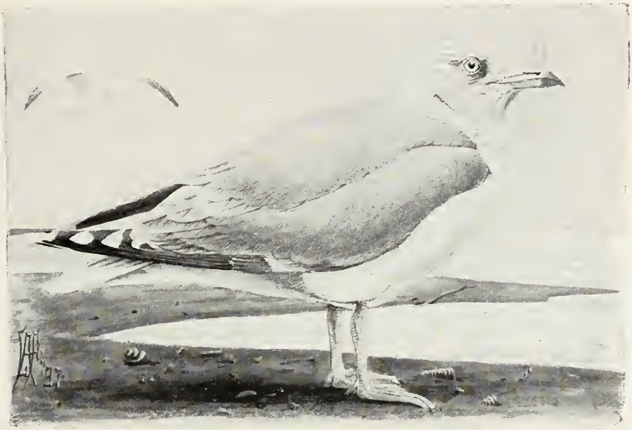
The Virginia Quail or Bob White is holding its own fairly well in Minnesota in spite of our severe winters, pushing its way farther north when conditions are favorable. This bird is such a good friend of the agriculturist that it deserves protection although its fine qualities as a table bird make it an object of pursuit on the part of hunters. Potato bugs and even chinch bugs have been found in its crop and grasshoppers as well as many other varieties of injurious insects compose a large proportion of its bill of fare.

THE AMERICAN WOODCOCK.



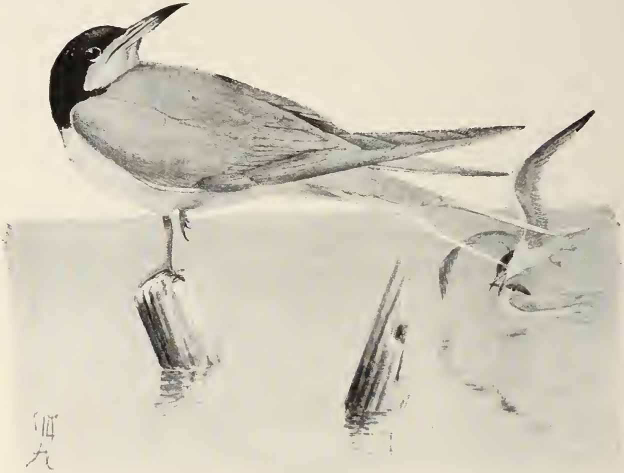
A somewhat rare bird in Minnesota, frequenting the low, wooded, water-courses and generally resorting to the higher lands only during the night. This beautiful game bird is pre-eminently a night-flier and a night-feeder. Its large eyes, placed well toward the top of its head, are not only enabled to gain impressions from above, when the bird's soft beak is buried in the mud, but also are in a position to receive all available light. When flushed, the bird rises softly, directly upward until clear of the brush and then pauses an instant before starting away from the intruder. Their four buff-colored eggs spotted and blotched with brown, are laid on leaves on the ground in an excuse for a nest. This bird has no economic bearing upon agriculture. It is protected in Minnesota until 1918.

THE HERRING GULL AND COMMON TERN.



The gull family was mentioned in Circular 32 as a group beneficial to farmers living in a prairie country. At the time, we referred particularly to the Black Tern so abundant in many of our prairie sloughs, as a catcher of grasshoppers and, while no illustration of this bird is available, we are pleased to be able to present an excellent drawing of the Common Tern in this publication which will serve to illustrate the group.

The Herring Gull—a good scavenger upon the shore of lake or ocean, typifies the larger members of the family and the species itself, while not as abundant perhaps as other gulls which breed in some of our lakes—is, nevertheless, a Minnesota summer resident, arriving in the southern part of the state early in April, shortly after that working its way north, where some at least nest in our larger lakes, notably Lake Mille Lacs. I have observed them at Devils Lake, Otter Tail County, in October and also find the following observations amongst my notes taken some years ago: "At Lake Mille Lacs, after the wind has been blowing from the East a day or more, these gulls and the two following species, namely *L. delewarensis* and *L. philadelphia*, are plenty along the west shore, flying up and down the beach and occasionally alighting to pick up small lacustrine mollusks washed ashore with the weed matter. About two miles from the south shore of the lake lie three barren, rocky islands, which are frequented by the gulls in the breeding season. The larger of the three, called Stone Island,—or Spirit Island by the Indians—containing about three-quarters of an acre and with its top about 20 feet above the surface of the water, affords on its rocky surface a nesting place for hundreds of gulls."

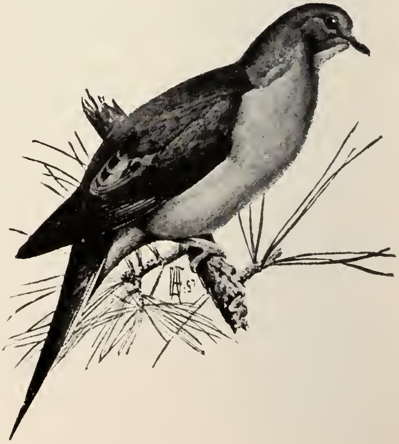


The Common Tern.

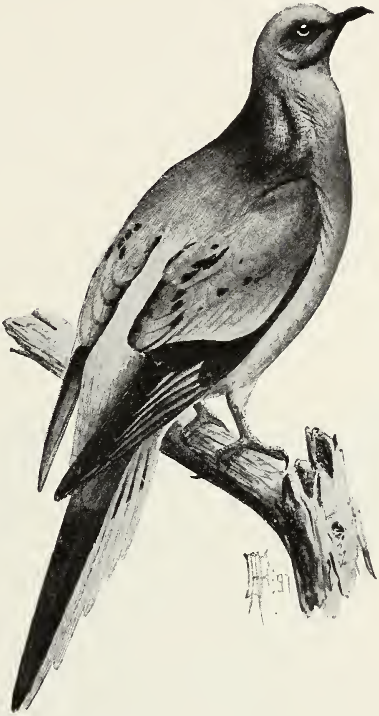
Stomachs of the Herring Gull are found to contain grasshoppers, fish, mollusks, and, in one instance, the remains of a marsh hare, possibly consumed as carrion. Professor Aughey reported finding in the stomachs of each of four Black Terns from 47 to 84 grasshoppers or locusts, and in two stomachs examined, from 28 to 59 other insects.

THE MOURNING DOVE.

Discussed quite fully in Circular 32, but at the time, we were not able to present an illustration. The drawing is included here for comparison with that of the Passenger Pigeon or Wild Pigeon with which the species is sometimes confused. This dove was formerly included amongst the Minnesota game birds, with a regular open season, but it is now protected until 1918. In some localities in Minnesota referred to as "Ground Dove."



THE WILD PIGEON.



A vanished bird. Several reports from various localities in Minnesota have reached the University of the occurrence of this beautiful bird so common years ago, within the confines of the state, but these rumors appear to have arisen either from confusing the Mourning Dove with this species, or to have been fakes, pure and simple. So far, the reward of $1,000 for a pair of these birds nesting has not been claimed. The writer has been, in the past, familiar with the appearance of the Passenger Pigeon at the time when it was extremely abundant in Minnesota and must confess to having been startled a few years ago in traveling by train from Crookston to Bemidji, at catching a momentary glimpse from the car window of two birds in flight amongst the trees, wonderfully resembling in size, color, and shape, the Passenger Pigeon of yesterday. No opportunity was afforded, however, to prove this and he dismissed the idea as absurd.* The glory of discovering the existence (if it does exist) of this former summer resident still remains for some aspiring ornithologist.

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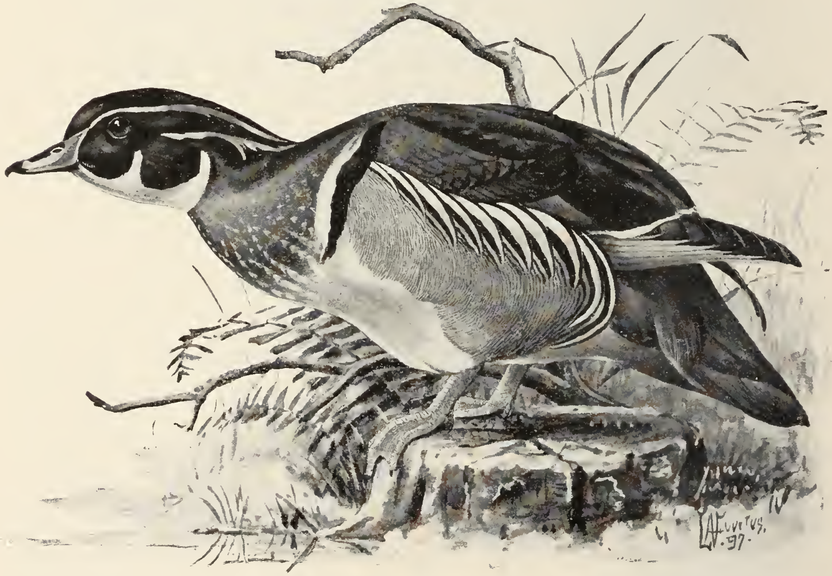
*In this connection it may be noted that Francis L. Palmer of Stillwater, Minn., a student of birds, claims quite emphatically to have observed one of these birds on May 31, 1915, near the above named town, which is in the southeastern part of the state. His observations were published in "Bird Lore" for July-August, 1915, page 289.

There is no need of confusing these two birds. The wild pigeon is 16¼ inches long; the ground dove only 11¾ inches, approximately. The upper part of the former are dove-colored or bluish-slate with metallic reflections on the sides of the neck of the male, while the upper parts of the dove are grayish-brown. The nests of both consist of small twigs loosely put together and containing in each case two white eggs.

THE WOOD DUCK.

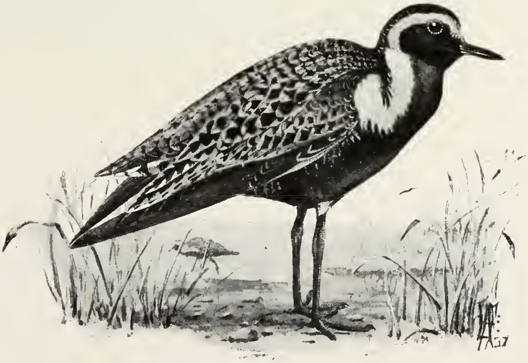


A bird like the woodcock and some others, rapidly growing more scarce in Minnesota and included here with the Golden Plover as representing our "vanishing birds." Strikingly tropical-looking is the male bird. In the above excellent illustration imagine the sides of the face and soft crested crown, green with purplish reflections, contrasting sharply with the white of the upper throat, the breast a rich, purplish chestnut, finely spotted with white; sides yellowish, delicately pencilled with black, with ends of flank feathers sharply barred with black and white. Back blackish or brownish, with green reflections, and long wing-feathers, bluish with green reflections. The eye (iris) bright red. A veritable prince amongst ducks, capable of domestication and worthy of most careful protection. What fisherman, wading a wooded stream, or Nature-lover idling on the bank of a secluded pond, has not been delighted by the flashing colors of these beautiful birds as they leave the water, startled at the approach of an alien, or entranced as they disport themselves in sylvan pool, quite unconscious of the admiring glances they invite!

Dr. P. L. Hatch, in his notes on the birds of Minnesota, 1892, voicing his enthusiasm over this duck, breaks into song as follows: "The most truthful and esthetic description of the mature male could reach no nearer the limning reality than the coldest prose could paint the rainbow. Science, after all her most imposing assumptions, would sit down and weep before the task in black despair. The impotence of all attempts has smirched the skirts of hope by what has been essayed in its systematic, as well as its vernacular nomenclature. *Aix sponsa!* Shades of Linnaeus, weep cold, clammy tears for thine irremedial dereliction! Wood Duck! Summer Duck!"

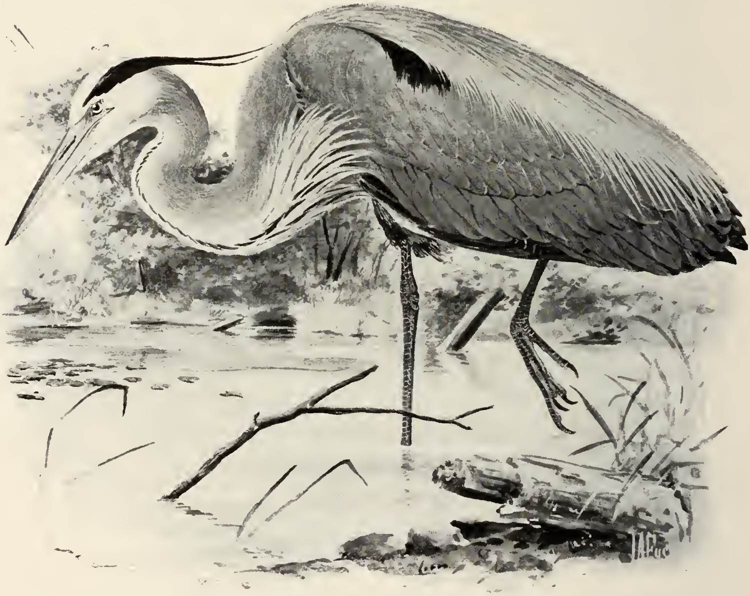
Unlike the majority of ducks, these birds breed in hollow trees overhanging the water. They are typically North American, ranging from Florida to Hudson Bay, but wintering far to the south of our most southern borders. Protected in Minnesota until 1918.

THE GOLDEN PLOVER.



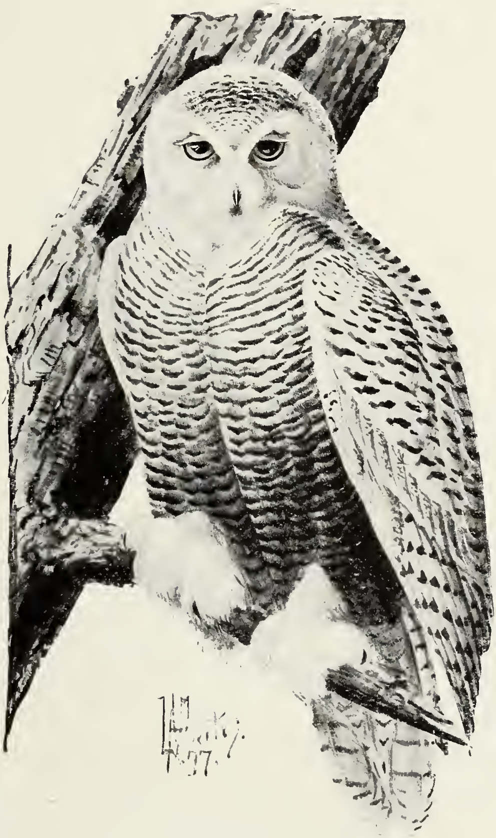
A bird also uncommon, in that it is here irregularly during the migrations remaining with us only a short time, and now, we believe, rapidly disappearing. The illustration is given here as representing the type, one of which—the Ring-Neck—was discussed in Circular 32. While with us, the food of the Golden Plover consists chiefly of grasshoppers and other insects. Together with the Upland Plover or Field Plover, another vanishing bird, it is protected in Minnesota until 1918.

THE BLUE HERON.



Another of our wading birds, wrongly referred to frequently as "Crane." The cranes, be it said, are rather birds of the plains and prairies—not of wooded sections, where we find these fishermen abundantly represented. Its food consists of frogs and fish, but grasshoppers and field mice are not scorned. Like the kingfisher, it may become destructive when frequenting the ponds of the fish-breeder.

THE SNOWY OWL AND GREAT HORNED OWL.



As supplementing a plea made in Circular 32, in behalf of birds of prey as a class, we introduce here figures and brief notes of two of our owls not mentioned in the earlier publication. The first-named, to be sure, is not a common bird in Minnesota. When seen, it is generally in the winter season, at which time we have occasionally observed it in the bare fields. Our field notes, however, show that this bird was met with occasionally in Otter Tail County in October and November, some years ago. It is, however, distinctly a boreal bird, pushing its migrations southerly only in its search for food.

The Great Horned Owl, however, arriving here sometimes as early as February is a common bird within our state borders.

Rabbits, gophers, muskrats, field mice, and other night-prowling animals represent a large share of the diet of this owl; poultry, too, if farmers allow their turkeys and chickens to roost in tops of trees, on sheds, or on exposed farm wagons. Even skunks (note the illustration) are highly prized by them for food; in fact, when captured, they are frequently strongly scented with skunk odor. With the exception of the skunk, which is ordinarily a useful citizen, the other mammals mentioned must be regarded as injurious—most of them decidedly so; hence this owl is, to a large degree, a benefactor.

Great Horned Owl

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No.36

OFFICE OF
STATE ENTOMOLOGIST
ST. ANTHONY PARK, MINN.

CIRCULAR NO. 36
JAN. 30, 1916

MAR 14 1916

THE RED ROSE BEETLE

~~Illinois State Laboratory of Natural History~~
Library

LETTER OF TRANSMITTAL.

Minnesota Experiment Station,
January 21, 1916.

His Excellency,
J. A. A. BURNQUIST,
St. Paul, Minn.

Dear Sir: I submit herewith manuscript of a paper entitled "The Red Rose Beetle," by S. Marcovitch, assistant with Professor William Moore, of the State Entomologist's Department. This manuscript represents the results of some original work upon the habits and life history of this insect pest of roses, and I recommend its publication as Circular 36 of the State Entomologist's Department, which by law is under your supervision.

Respectfully,
F. L. WASHBURN,
State Entomologist.

Approved:
J. A. A. BURNQUIST,
Governor of Minnesota.

THE RED ROSE BEETLE

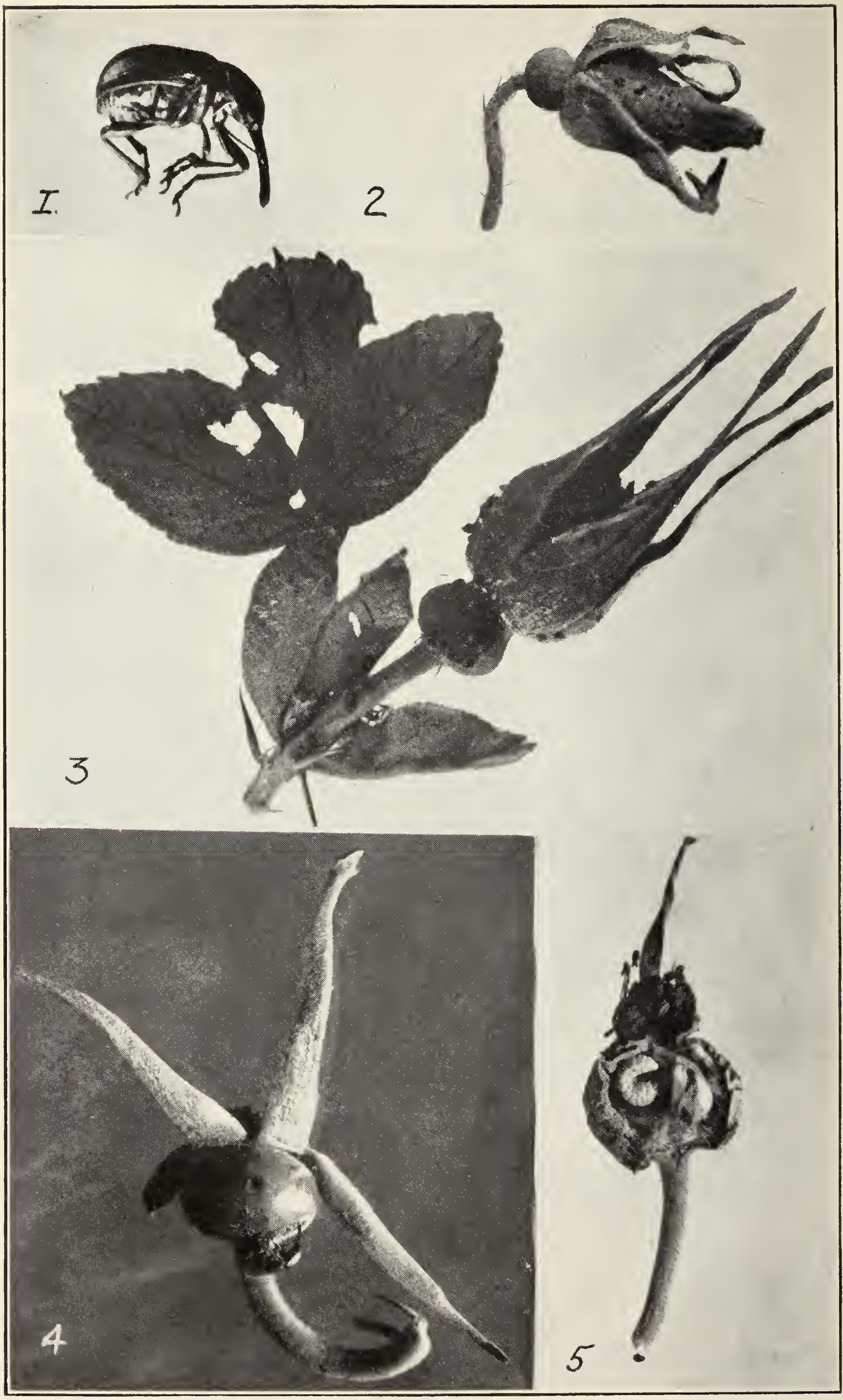
Rynchites bicolor, Fab.

In the early summer, when the Japanese roses are still in bud, one may very often find a reddish snout beetle with a black head and beak puncturing the buds full of holes. Even though the insect may appear in small numbers, most of the flowers will be so full of holes as to be worthless. The beetles also bore holes into the stems, causing many of the buds to wither and the hips to be undersized.

Name.—This insect is at present called the Rose Curculio. Since there are other snout beetles attacking the rose and as this beetle is not one of the true Curculionidae, it seems to the writer that a better name would be the Red Rose Beetle. Its bright red thorax and wing covers make it conspicuous and easily distinguished..

Varietal Susceptibility.—It was found that in the form, *Rosa rugosa,* the common Japanese rose, the eggs are laid within the hips, and not in the flowers or elsewhere. However, with *Rosa rugosa alba,* a white variety, the larvae were found within the flowers on July 22, to be already about half-grown. It appears, then, that in this variety, the eggs are laid in the flowers, and later the larvae may crawl into the hips. After eggs have been laid in the flowers of *R. rugosa alba,* the beetles probably puncture the stem either deliberately or accidentally, due to their voracious feeding habits, for the flowers remain closed and the hips become dried and shriveled. Fig. 2.

Larva.—Length 4½ to 5 mm. x 2 mm. wide. Width of head about 1 mm. Whitish or yellowish in color. Head same color as body except for portion above epistoma, where it is brownish in color, the coloration extending somewhat farther along the median suture. Epistoma dark brown; clypeus and labrum light; mandibles nearly all black and with three teeth. Labrum wider at base and bristly in front. Antennae minute, one-jointed and situated at base of mandibles. Body strongly curved and covered with numerous small hairs. The spiracles, one on the prothorax

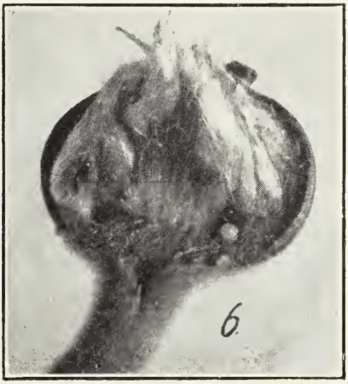


EXPLANATION OF FIGURES.

Fig. 1. Adult beetle (Enlarged). Fig. 2. Bud of *R. rugosa alba* injured and containing larva. Fig. 3. Work of beetle on bud, hip, petiole and leaves. Fig. 4. Beetle at work. Fig. 5. Hip opened showing larva. Fig. 6. Hip opened showing egg. Fig. 7. Larva (Enlarged).

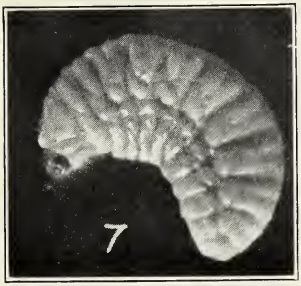
and eight abdominal, are round and possess two cylindrical lobes closely together. These are about as long as the diameter of the spiracle and point towards the dorsum.

Egg.—The egg is 1 mm. long by .6 mm. wide. It is greenish yellow in color, oval, and smooth.



In Colorado, specimens were found in which the greater part of the head, legs, and antennae are red, similar to the thorax and wing covers. Mr. Alexander Crane, entomologist of the California State Board of Horticulture, mentions this species as attacking ripe blackberries and raspberries.

Life History.—The adult beetles were first observed on June 10, already making holes in the buds. On June 28, eggs were found deposited within the hips about one or two mm. below the surface. The eggs hatch in from six to ten days, and the larvae immediately begin boring into the seeds. About one day previous to hatching, the mandibles of the embryo larva can be seen to be moved back and forth.



Egg Puncture.—As many as 5 or 6 egg-laying punctures may be present on a single hip. These can be distinguished from the feeding punctures in that they are blackish and covered over, with no noticeable depression.

On August 10, eggs were still found within the hips, but no eggs were found in the buds. Full grown larvae were found within the hips the last week in August, although most of them mature about the middle of September. Two or three larvae may be present in a single hip. When they become nearly full grown, the hip begins to show a wrinkled appearance, due to the attacks of the larvae within. On August 20, the writer found a few flowers and buds that were free from the holes, probably because these had matured later and the beetles had already disappeared.

Hibernation.—On September 3, the larvae were beginning to leave the hips, while on September 18, most of them had already deserted the hip to go into the soil. Here they remain as a larva thruout the winter, changing to a pupa in the spring, and then to the adult form.

Control.—Since the larvae remain over winter in the soil, cultivation around the bushes in the late fall and early spring would kill many of them. On a small scale, the adult beetles may be hand-picked. A surer way, however, is to pick the hips containing the larvae before August 15 and burn them. In case of *Rosa rugosa alba,* the dried flower buds contain the larvae and should be picked before August 1, before they drop to the ground, and burned likewise. In large nurseries, the beetles can be easily killed by spraying heavily with lead arsenate.

S. MARCOVITCH.

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No. 37

OFFICE OF
STATE ENTOMOLOGIST
ST. ANTHONY PARK, MINN.

CIRCULAR NO. 37
FEB. 1, 1916

Entomologist's Report on Inspection of Minnesota Nurseries and Imported Nursery Stock for the Year 1915

MAR [illegible] 1916

~~Illinois State Laboratory of Natural History~~
Library

LETTER OF TRANSMITTAL.

Experiment Station,
St. Anthony Park, Minn.,
Jan. 21, 1916.

His Excellency,
J. A. A. BURNQUIST,
St. Paul, Minn.

Dear Sir: I have the honor to transmit herewith the manuscript of report on State Nursery and Orchard Inspection for the year 1915, and recommend its publication as Circular 37 of the State Entomologist's Department, which by law is under your supervision.

Respectfully,
F. L. WASHBURN,
State Entomologist.

Approved:
J. A. A. BURNQUIST,
Governor of Minnesota.

OFFICE OF
STATE ENTOMOLOGIST
ST. ANTHONY PARK, MINN.

CIRCULAR NO. 37
FEB. 1, 1916

REPORT ON NURSERY AND ORCHARD INSPECTION AND INSPECTION OF FOREIGN STOCK FOR THE YEAR 1915

His Excellency W. S. Hammond,
State Capitol,
St. Paul, Minn.

DEC. 1, 1915.

Dear Sir: I have the honor to transmit herewith report on nursery inspection for the year 1915, as required by law, and desire to testify my appreciation of your kindly and helpful interest in the work of the Entomologist.

The work of inspection has increased materially each year in Minnesota and the nursery business is becoming more and more an important asset in this state. We can urge the citizens of Minnesota, in view of the splendid stock and large assortment of hardy fruit trees and shade trees carried by the nurserymen, to plant Minnesota-grown stock as far as possible. The nurserymen appear to appreciate the necessity of combating crown gall on raspberries, and, as a result of their efforts, we find crown gall on raspberries less abundant than in previous years, though still an important enemy to raspberry growing.

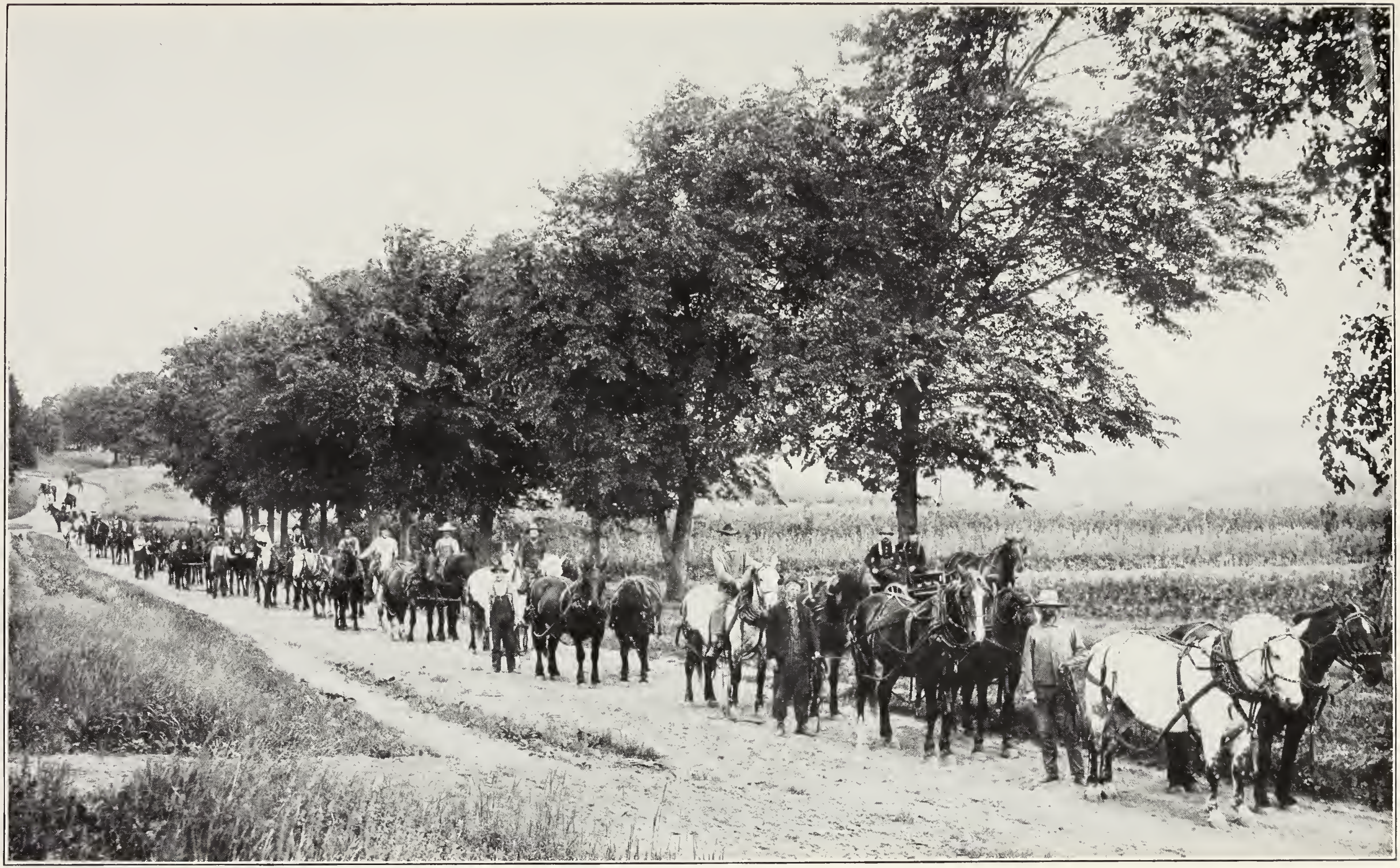
In traveing about the state last summer, the Entomologist was struck by the lack of orchards in the central part. There are hundreds of acres of land between Long Prairie and Wadena and north of Park Rapids containing but few fruit trees. In a hurried trip through this section, miles of what would seem to be desirable orchard land were passed between Brainerd, Little Falls, and St. Cloud, with not a fruit tree showing. The Swan River Valley also, where but few fruit trees were seen, should have its gentle slopes and hillsides dotted with orchards.

The wet weather last spring and early summer caused a remarkable growth of weeds in nurseries, and the wet ground made it difficult to eradicate these, but nevertheless, the nurseries are in quite good condition throughout the state. The season was favorable for extensive growth of all nursery stock.

In order to permit private citizens to ship a few trees or shrubbery or plants to friends, or perhaps from the country to their own places in the city, we have inaugurated a system of permits, that the law may be complied with. It is only necessary for a citizen to send the name and address of both consignor and consignee, the number of packages and variety of stock each contains, and the probable date of shipment and we issue a permit which takes the place of the nurserymen's shipping tag, and is accepted as such by the express or freight agent or postmaster. A record is kept of parties receiving permits and the numbers of same and if it is evident, from the number of these records that a business of some magnitude is being transacted by any party, without proper inspection of stock, issuance of permits to that party ceases, with a suggestion that they conform to the law and obtain a regular certificate. In other words, these permits are not intended for use in the nursery trade.

Christmas trees shipped into our cities from wooded sections are of course exempt from the rules of our inspection laws. Deprived of their roots, they could in no way be regarded as nursery stock nor would they in that condition come under the designation of forest trees—the latter being subject to the regulations of the Inspection Service. Express and freight agents should govern themselves accordingly.

The presence of crown gall on raspberry or blackberry plants disqualifies a nurseryman from receiving a certificate until the affected block or blocks of plants are destroyed. The presence of the hairy root form of crown gall on apple would also disqualify if observed. The presence on apples of a large amount of crown gall in the "hard gall" form would, when found, call for a request from the inspector that the nurseryman eliminate such stock, for business interest if for no other reason. At the same time, while pointing out to nurserymen the infectious character of the disease, in view of the fact not only observed by the inspector but also claimed again and again by practical growers, that in Minnesota, trees affected with the "hard gall" form of the disease, are not seriously impaired as to growth and bearing qualities, the Minnesota inspector does not disqualify a nurseryman if a moderate amount of this disease is found in the nursery. Nevertheless, the fact that these trees so affected are rejected by law in many states (and in fact this form of the disease may be destructive to trees in other latitudes and in other soils) is emphasized so strongly by the Minnesota inspection force that nurserymen need no further stimulus to eradicate it as far as possible when found.



Teams starting to work in one of the larger Nurseries

If our appropriation would permit, a winter inspection of apple and cane stock while in the cellar, would be helpful in this connection.

We have inspected 120 nurseries this year, of which nurseries 115 have received certificates, the remaining four not having as yet paid the legal fee and therefore not having as yet been so favored; also dealers' certificates have been granted to eight dealers. Collections have been made to the amount of $625, which has been turned in to the State Treasury and receipt received for same.

IMPORTED STOCK.

In the matter of imported stock, it is surprising to note that in spite of the war, and all that it means to Belgium, the importations of azaleas this fall have been nearly as extensive as in years previous to 1914. The azaleas arriving from Belgium in large numbers have reached Minnesota in excellent condition, showing every evidence of care in cultivation, digging, and packing. Cases of imported stock, including azaleas and ornamentals, to the number of 594 boxes, have been inspected to date, representing approximately 518,330 plants.

The allies have placed a very effectual stopper on importations from Germany, the Belgian and we believe also the Holland dealers having to make affidavit that the stock to be shipped via the English channel has been grown in one or the other of these two countries.

Further, the amount in cash for which each azalea shipment is sold has to be deposited in an English bank to remain there until after the war. Quoting from a statement in "American Fruits," when this is done, a "permit may be issued allowing free passage for such shipment. According to a letter from a Dutch firm of growers, after this became known, the Belgian Exporters' Association was notified by the German authorities, who have possession of that part of Belgium where these plants are grown, that in the circumstances export would not be allowed." Yet, in spite of this prohibitive decree, Minnesota has been receiving large consignments from Belgium as above noted. The 594 cases above mentioned came from the following countries: From Belgium, 218 cases; from Holland, 279; from France, 65; Japan, 22; Germany, 5; England, 5.

We find that stock coming from Holland is, almost without exception, free from insect pests and beautifully packed. This is also true of azaleas shipped from Belgium. These latter plants reach us in such fine shape and so free from insect pests that we have adopted the plan of allowing the importer to unpack shipments, keeping them together, and preserving all tags, records, and numbers on boxes (burning packing), pending the arrival of the inspector. This saves us additional trips to a distant locality to examine small consignments arriving later than the main part of the shipment.

Inspections of Imported Plants.

Dec. 1, 1914, to Sept. 1, 1915.

Number of plants		502,180
Number of cases—		
From Belgium	53	
From Holland	234	
From France	65	
From Japan	22	
From Germany	5	
From England	4	
	——383	

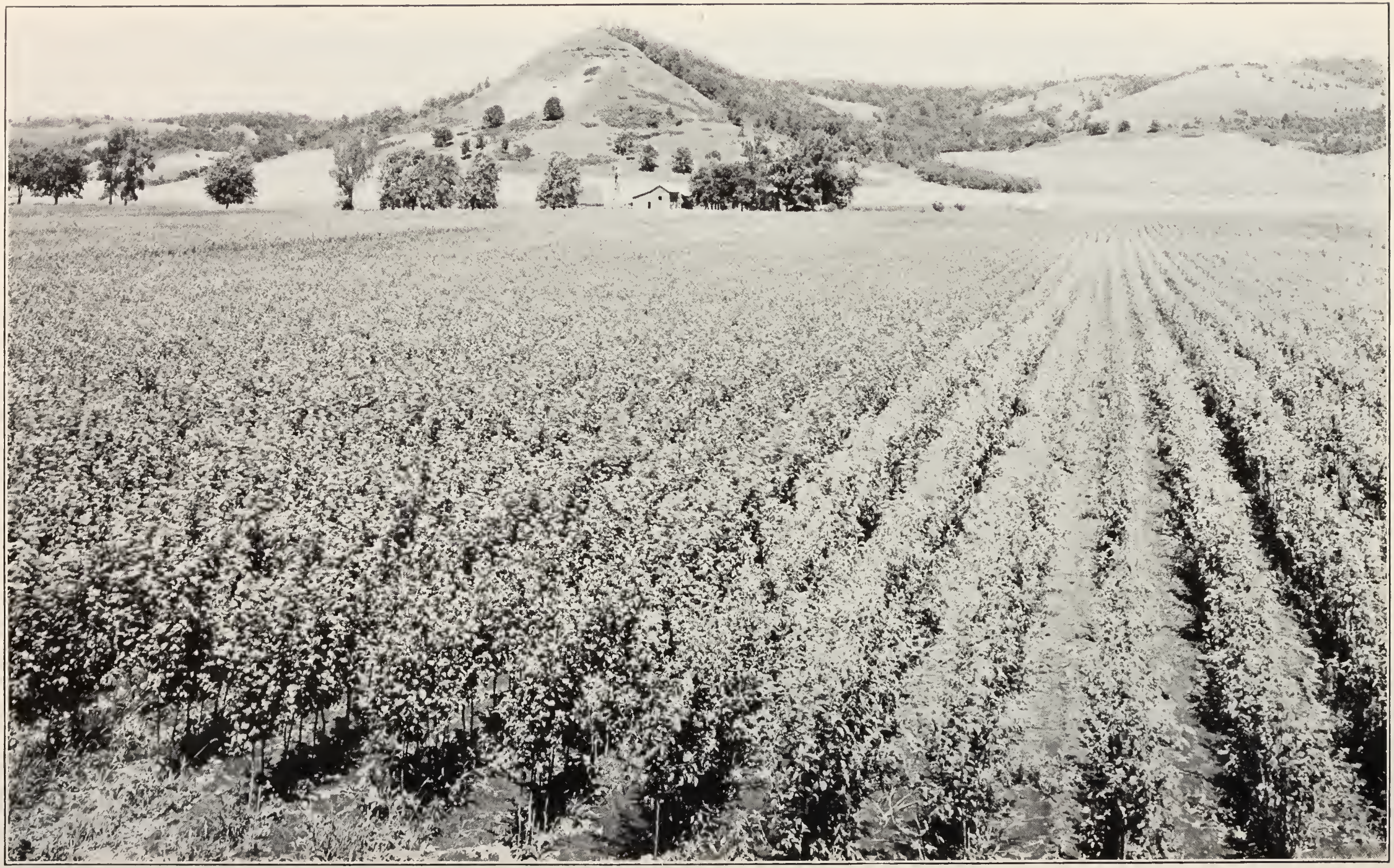
Sept. 1, 1915, to Dec. 1, 1915.

Number of plants		28,150
Number of cases—		
From Belgium	181	
From Holland	73	
From England	1	
	——255	
Total number of cases	638	
Total number of plants		530.000
Total number of cases from Belgium		234
Total number of cases from Holland		307
Total number of cases from France		65
Total number of cases from Japan		22
Total number of cases from Germany		5
Total number of cases from England		5
Total cases		638

The inspection service works in coöperation with the Federal Horticultural Board, receiving from Washington the notice of all shipments of nursery stock from abroad and being advised of all quarantine measures imposed by the Government.

The White Pine Blister Rust.

This disease, found on pines and, in one stage, on species of Ribes (currant and gooseberry), has become such a menace to our forest interests that not only has the Federal Horticultural Board forbidden the entry of all pines into this country from Europe, but is also considering a quarantine of areas in the United States already infested. This is a matter calling for the closest cooperation between the Plant Pathologists, the Forest Service, and the Nursery



Part of a field of 500,000 2-year-old Apple Trees and Orchard Inspection Services in the various states, particularly in those states where lumber interests are represented.

For four years we have been watching a planting of imported pines in a Minnesota nursery and, up to date, have not observed the appearance of this disease. Nevertheless, we plan for the coming season a careful survey of all nursery stands of species of pines as well as those of currants and gooseberries, besides a checking up of all shipments of these forms into Minnesota, and far as possible, their ultimate distribution therein. To do this properly, generous cooperation upon the part of the Plant Pathology Division of the Experiment Station will be necessary.

At a recent conference (March 2, while this report was with the printers) of representatives of the Minnesota Forestry Board, the Minnesota Forest Service, the College of Forestry, the Minnesota State Forestry Association, the Horticultural and Plant Pathology Divisions of the Minnesota Experiment Station, and the Minnesota Nursery Inspector, a resolution was unanimously passed to the effect that we strongly urge the Federal Quarantine Board to quarantine those areas (as regards shipment of pines and Ribes) which are known to be infested with white pine blister rust, and the Secretary of the Conference was also instructed to write to the Minnesota senators and representatives, urging them to act favorably upon H. R. 9802, introduced by Mr. Wason.

Since large consignments of pines, currants, and gooseberries have probably been received from infected areas, by large nurseries in the United States, nurserymen and other importers are urged to avoid placing orders for pines or currants or gooseberries at the present time with wholesale dealers. In this connection it may be stated that a quarantine is just about to be issued by the Federal Horticultural Board, preventing the importation of five-leafed pines, as well as all currants and gooseberries from Canada and Newfoundland. This disease is very slow to appear on plantings of pine. Its first appearance dates possibly three years after the pines are set out, in this climate, although it might not appear until considerably later. It is recognized by yellow spots on the bark of the pine with irregular white edges, first appearing as irregular swellings or blisters, which swellings or blisters later break open. The yellow color is caused by the presence of the powdery-like, yellow spores. On currants and gooseberries, it is observed in the form of very small, yellowish powdery masses on the under side of the leaves about the size of the head of a pin. It must not be confounded with the other yellow spores seen commonly on our gooseberries, the patches of which are much larger.

Any nurseryman, observing anything at all suspicious upon his pines, should at once report the fact to the Inspection Service. It would be well to advise this office of any plantings of European pines in one's nursery occurring at any time within the past eight or ten years.

The Entomologist publishes, at intervals during the year, a "News Letter," mailing to all nurserymen, dealers, and florists on our lists. This publication contains items of common interest to nurserymen, florists, and the Nursery Inspection force.

It is to be regretted that the inspection law is not so worded as to authorize this department to act when diseased tubers (potatoes, for example) or infested or diseased fruit is shipped into Minnesota. Under present conditions, we are powerless in this connection and Minnesota might easily become a dumping ground for such material.*

The Minnesota Inspection Service feels hardly justified in taking a parental attitude toward our nurserymen similar to what is found to prevail occasionally in some states. In other words, the State Entomologist does not feel authorized either to criticize business methods on the part of his nurserymen constituents, or to pass upon business relations existing between nurserymen and their patrons. A most cordial and friendly feeling exists between the inspector and inspected in Minnesota, and in the light of this friendship, we may repeat to a nurseryman privately a criticism upon stock sold, made to us, if such action upon our part is likely to prevent a repetition which may injure the nurseryman himself. We have also, upon rare occasions, upheld patrons in their claim that satisfactory stock had not been furnished. On the other hand, we do not feel that it lies within the power of the Entomologist to interfere with or restrain trade by commenting to any purchaser of nursery stock, upon prices paid or claims made as to value of stock furnished. Whatever personal views the inspector may have, he carefully refrains from voicing, believing that to be the most desirable and really the only position to take in his official capacity. A diseased or insect-infested tree or shrub furnished a patron would of course bring upon the nurseryman selling the same the private criticism of the inspector and an admonition.

Nursery inspection in this state at present is in an educational stage. It serves as a check upon the introduction and spread of injurious insects and plant diseases, but it does more than that in

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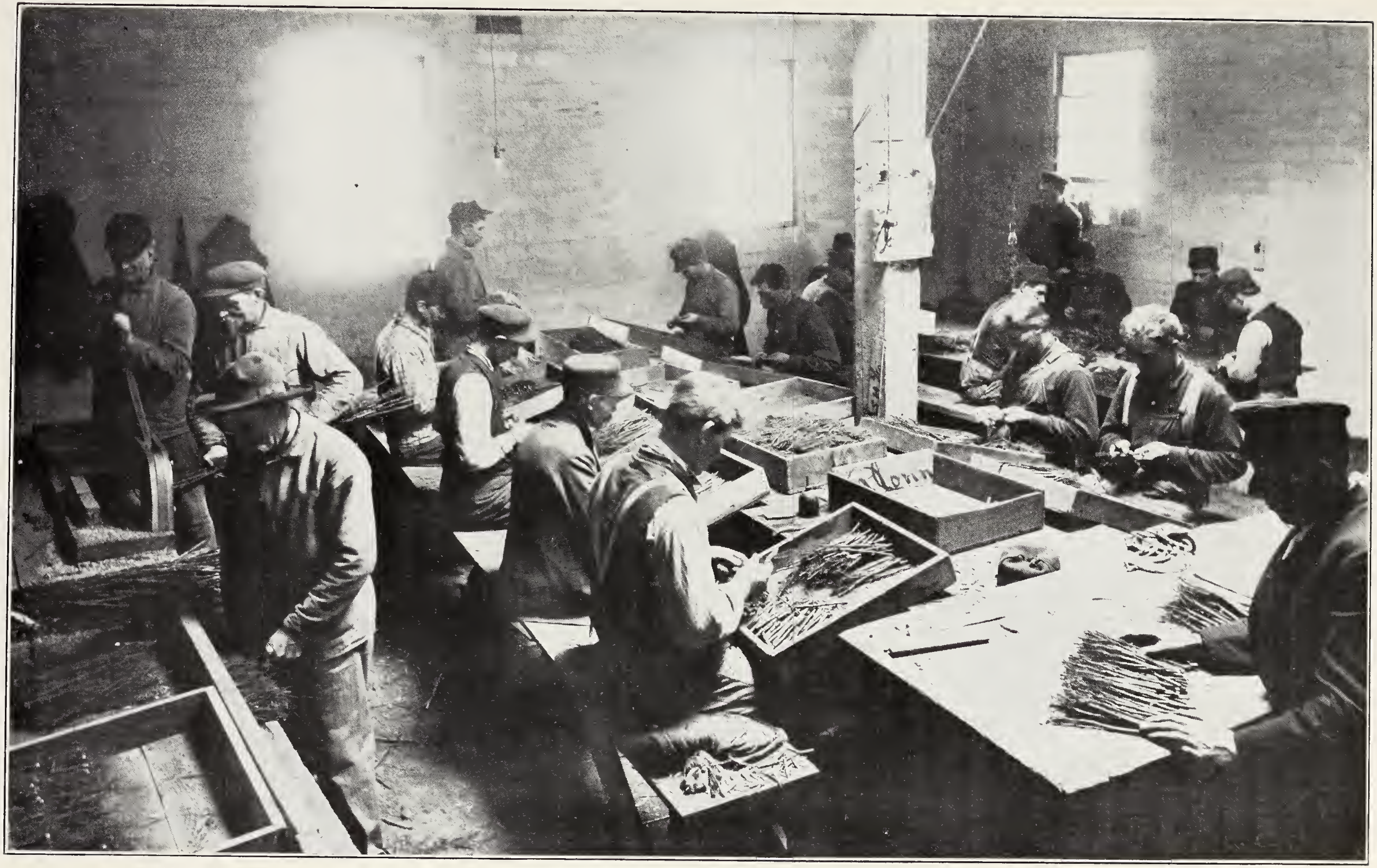
*Since the above was dictated, the Entomologist has been authorized by the Federal Board to take charge of a case of shipment of diseased potatoes coming from Canada into Minnesota contrary to the U. S. law.



Making Apple Grafts

that it compels attention to pests and diseases hitherto not understood or even noticed. Since it is educational and coöperative with University departments, it would seem unwise to separate it from the University at this time and place it under state control, apart from the University, unless a group of allied subjects sufficiently large to dignify it with the name of "Department of Agriculture" be organized for that purposes and precautions taken to guard the work against political interference. Nurserymen appear to be universally in favor of the work being retained by the University.

During the spring and summer of 1916, the Inspection Service, in addition to its regular inspection work, plans to begin a survey of orchards in each fruit-growing county in the state to determine whether seriously injurious insects are present, what species are represented, and how serious is the infection. In this connection, it might be mentioned that the English sparrow, when present in an infested locality, has been found to be an active worker in spreading the San Jose scale wherever this scale is abundant; and other birds nesting in orchards may, in a lesser degree, because of their smaller number, be guilty of the same offense. Orchardists, therefore, desirous of ascertaining whether or not this scale is present, would do well to look in the neighborhood of old birds' nests and in trees or shrubbery which offer favorite perching places for English sparrows. A neglected plum thicket may also harbor this scale.

MINNESOTA INSPECTED NURSERIES.

1915.

All certificates issued in 1915 expire November 1, 1916, thus covering both spring and fall shipments of 1916, and avoiding delays in securing new certificates.

Name of Nursery	Town	Certificate No.
The Albert Lea Nursery C. M. Peterson	Albert Lea	756
The Minnesota State Nursery E. C. Baker	Albert Lea	753
The South Side Nursery Martin Fridholm	Albert Lea	755
The Wedge Nursery Clarence and Robert Wedge	Albert Lea	754
Alexandria Fruit and Poultry Farm W. H. Horton	Alexandria	804
College of Forestry	Arago and Cloquet	810
The Askov Nursery Ludvig Mosback	Askov	708

Austin Nursery C. F. Woodle	Austin	775
Turtle Creek Nursery J. M. Lindsay	Austin	779
Battle Lake Nursery A. A. DeSmidt	Battle Lake	815
Itasca Park Region Nursery L. P. Anderson	Bemidji	808
The Lyron Nursery F. E. Cutting	Byron	792
Oslund's Nursery N. N. Oslund	Cambridge	819
Sivert's Nursery Peter Sivert	Canby	741
Fillmore County Nursery G. F. Snyder	Canton	790
The Cokato Berry Farm A. L. and F. Lee	Cokato	742
The North Star Farms J. W. Beckman	Cokato	744
The Wright County Nursery John Eklof	Cokato	743
The Schuster Nursery Edw. W. Schuster	Crookston	811
The Flyen Nursery (Dealers) Henry Flyen	Dawson	20
The Delano Nursery Chas. Sell	Delano	714
The Greysolon Nursery C. E. Roe	Duluth	709
The Eagle Bend Nursery T. W. Taylor	Eagle Bend	802
East Grand Forks Nursery Oscar Wick	East Grand Forks	805
The Brackett Nursery A. Brackett	Excelsior	826
Highlands Fruit Farm C. S. Jackson Land Co.	Excelsior	821
Minnetonka Old Fashioned Flower Garden Mrs. N. S. Sawyer	Excelsior	725
The Amber Lake Nursery P. C. Christensen	Fairmont	768
The Commercial Nurseries of Fairmont (Dealers) G. D. McKisson	Fairmont	26
McKisson's Fairmont Nursery G. D. McKisson	Fairmont	770
The Andrews Nursery John Andrews	Faribault	763
The Brand Nursery Brand Nursery Co.	Faribault	764
The Farmers Seed and Nursery Co. Wm. Kueker	Faribault	765
The Wilwerding Nursery A. J. Wilwerding	Freeport	813
The Mills Lake Nursery L. D. Mills	Garden City	748
The Lake View Nursery Victor Carlson	Grayling	806
Hughart's Sons' Nursery Hughart's Sons	Hamel	711
Howard Lake and Victor Nurseries W. H. Eddy	Howard Lake	740

A field of Young Evergreens

The Thorp Northwestern Plum Nursery Freeman Thorp	Hubert	706
Jeffers Trial Station Dewain Cook	Jeffers	732
Kenyon Nursery J. A. Mogren & Son	Kenyon	777
The Oak Grove Nursery P. H. Volstad	Kenyon	776
The South Kenyon Nursery E. J. Hershaug	Kenyon	778
The Kerrick Nursery Mrs. Margaret Culle	Kerrick	705
Ayers' Jack Pine Nursery H. B. Ayers	Kimberly	818
The Sunnyside Fruit Farm Frank I. Harris	LaCrescent	788
The Jewell Nursery Jewell Nursery Co.	Lake City	727
The Johnson Nursery (Dealers) P. G. Johnson	Lake City	25
The National Nursery J. F. Anderson	Lake City	728
The Sugar Loaf Valley Nursery Moseman Bros.	Lake City	729
The Tolleson Nursery G. A. Tolleson	Lake City	730
The Mayfield Nurseries L. L. May	Lakeland	767
The Kenyon's Riverside Nurseries J. M. Kenyon	Lamberton	734
The Motter Nursery J. P. Motter	Lamberton	735
The Benson Nursery J. M. Benson	Lindstrom	785
The Chisago Lake Nursery Ludwin Carlson	Lindstrom	784
The Ferguson Nursery C. W. Ferguson	Litchfield	737
The Morrison County Nursery Cornelius Kelly & Son	Little Falls	801
The Daniels Nursery Frank Daniels	Long Lake	797
The Minnetonka Nursery Douglas Winter	Long Lake	713
The Tong Nursery George Tong	Long Lake	712
The Lonsdale Nursery John Vikla	Lonsdale	757
The Luverne Nursery C. E. Older	Luverne	747
The Madison Nursery M. Soholt	Madison	749
H. Allan (Dealer)	Mankato	21
The Mankato Nursery L. Z. Smith	Mankato	731
M. M. Sinotte (Dealer)	Mankato	24
The Dodge County Nursery W. E. Fryer	Mantorville	781
The Orton Park Nursery C. J. Orton	Marietta	751
The Kidder Nursery E. D. Kidder	Marshall	750

The Minnesota State Nursery E. C. Eaker	Marshall	812
The Deerfield Nursery J. F. Brady	Medford	758
The Medford Nursery G. E. Patten	Medford	759
The Baker Nursery R. F. Baker	Minneapolis	720
The Board of Park Commissioners Theo. Wirth	Minneapolis	722
The Farmer Nursery E. A. Farmer	Minneapolis	803
The Franklin Nursery A. B. Franklin	Minneapolis	724
Holtzermann's Chicago Store Co. (Dealers) L. J. Holtzermann	Minneapolis	22
The Minneapolis Nursery A. Norlander	Minneapolis	793
Northrup, King & Co. (Dealers)	Minneapolis	27
The Rose Hill Nursery John Hawkins	Minneapolis	718
The Ruedlinger Nursery C. N. Ruedlinger	Minneapolis	796
The Vine Grove Nursery A. M. Shepard	Minneapolis	719
Teigland's Nursery J. L. Teigland	Minneota	739
The Variety Fruit Farm Mickel Oleson	Montevideo	746
The Combercroft Farm and Nurseries G. E. MacComber	Nemadji	716
The Pioneer Nursery The Pioneer Nursery Co.	New Ulm	733
The Northfield Seed and Nursery Co. J. M. Punderson	Northfield	766
The Dunsmore Nursery Henry Dunsmore	Olivia	752
The Clinton Falls Nursery T. E. Cashman	Owatonna	760
The Mitchell Nursery D. M. Mitchell	Owatonna	761
The Owatonna Nursery L. J. Wesely	Owatonna	762
The Elmwood Select Nursery Frank Brown & Son	Paynesville	807
The J. H. Bauer Nursery Jos. H. Bauer	Perham	809
The Graham Nursery O. J. Graham	Pine City	816
The Pine River Nursery Co. J. W. Witham	Pine River	704
The Plainview Nursery R. W. Chapman	Plainview	787
The Preston Nursery C. E. Snyder	Preston	774
The Evergreen Lawn Fruit Farm H. W. Harrison	Rochester	791
The Lake Sarah Specialty Farm F. C. Erkel	Rockford	814
The Vinegar Hill Nursery Wm. Sandrock	Rushford	789
The Sacred Heart Nursery J. T. Flagstad & Son	Sacred Heart	745

A field of 3-yr-old Wealthy Apple Trees

The St. Cloud Nursery Co. (Dealers) S. H. Gamble, Sec'y.	St. Cloud	23
The St. James Nursery and Greenhouses John J. Hill	St. James	769
The J. C. B. Andersson Nursery J. C. B. Andersson	St. Paul	800
The Bailey Nursery J. V. Bailey	St. Paul	726
The Hoyt Nursery B. T. Hoyt	St. Paul	721
The Park Nurseries Holm & Olson	St. Paul	717
The Nicollet & Sibley County Nurseries C. Edwin Swenson	St. Peter	736
The Meininger Nursery L. Meininger	Sherburn	771
The Minnewaska Nursery Paul P. Klevann	Starbuck	703
The Strand Nursery G. W. Strand	Taylor's Falls	783
The Tyler Nursery J. P. Ericksen	Tyler	707
The Maplehurst Nursery Grace E. Kimball	Waltham	780
The Cabinwood Nursery O. J. Wetherald	Wayzata	799
The Deephaven Nursery A. O. Hawkins	Wayzata	715
The Ferodowill Nurseries F. X. Ferodowill	Wayzata	798
The Hawkinson Nursery Chas. Hawkinson	Wayzata	710
West Concord Nursery F. J. Cowles	West Concord	782
The S. D. Richardson Nursery S. D. Richardson	Winnebago	773
The Winnebago Nursery John Van Blair	Winnebago	772
The Pfeiffer Nursery C. A. Pfeiffer & Son	Winona	786
The University Fruit-Breeding Farm Nursery State of Minnesota	Zumbra Heights	702

NURSERIES IN MINNESOTA NOT HOLDING CERTIFICATE OF INSPECTION FOR 1916.

The Lake View Nursery and Fruit Farm P. M. Perry	Excelsior
The Ellison Nursery F. H. Ellison	Minneapolis
The Hunter Nursery C. C. Hunter	Minneapolis
The Wyse Nursery Oliver Wyse	Onamia

We wish to acknowledge helpful assistance from the Plant Pathology Division of the Experiment Station during the year's work.

We have been fortunate in having the services, this year, of Mr. G. W. Peake as Deputy Inspector; we have also had occasion to employ extra help in order to inspect nursery or imported stock. We append, herewith, his report of work for the year just ended:

During the past year, there have been some changes in our methods of orchard and foreign inspection; that is, we are now trying to locate such pests as San Jose scale not only in our nurseries, but in our orchards. Our appropriation does not allow for very much of this work, but during the last season, some little work was accomplished along these lines and the coming season we are planning to extend this work so as to quite thoroughly examine an area of several counties. This work will be reported daily to the office of the State Entomologist where all records will be kept on permanent file. In our foreign inspection, we have found the best of co-operation in regard to care taken by greenhouse and nursery men. We have asked always that all packing be carefully collected and burned and have met with no opposition to this important ruling. In many cases it is expensive and inconvenient to go to a town out of the Twin Cities for each box of foreign stock shipped in and we have allowed the shipment to be unpacked and packing burned to await the final shipment in that locality or until we had more time for work. So far, we feel this is satisfactory for greenhouses, but of course for nursery stock which comes in the spring, we would not care to try it. Stock from Holland and Belgium and France came in even greater abundance than it has in years past. The imported stock, as a rule, was in very good condition and but few pests—none of any great importance—were found. In several cases we found an abundance of aphids and of oyster shell scale; some few other minor pests which were destroyed by dipping the dormant stock in tobacco solution.

The inspection of foreign stock in the spring of the year was accomplished, for the most part, by the Deputy Inspector, but at certain times, when large shipments of stock arrived at several places at the same time, or an extremely heavy shipment at one place, help was secured from experts in the Divisions of Plant Pathology, Horticulture, and Entomology. Through the courtesy of these men, we were able to keep the inspection work up to date.

During the early part of the summer, an extended trip was taken to trace some few shipments of mountain ash which originally came from Michigan and on which we had evidence of the possibility of San Jose scale being present. In no case was the scale found on these shipments, although many of the trees had died and been destroyed, so it was impossible to determine if scale had been present.

The summer inspection of nurseries was hampered to some extent by the weather conditions in the early part of the season, but although we had about forty more places to visit this year than last year, the summer work was completed so that it did not interfere with the inspection of imported foreign stock which came in this fall. The amount of imported stock from Europe is practically the same this year, but it is coming in very late—in many cases due to slow transportation after it reached the port of New York; that is, on our own railroads.

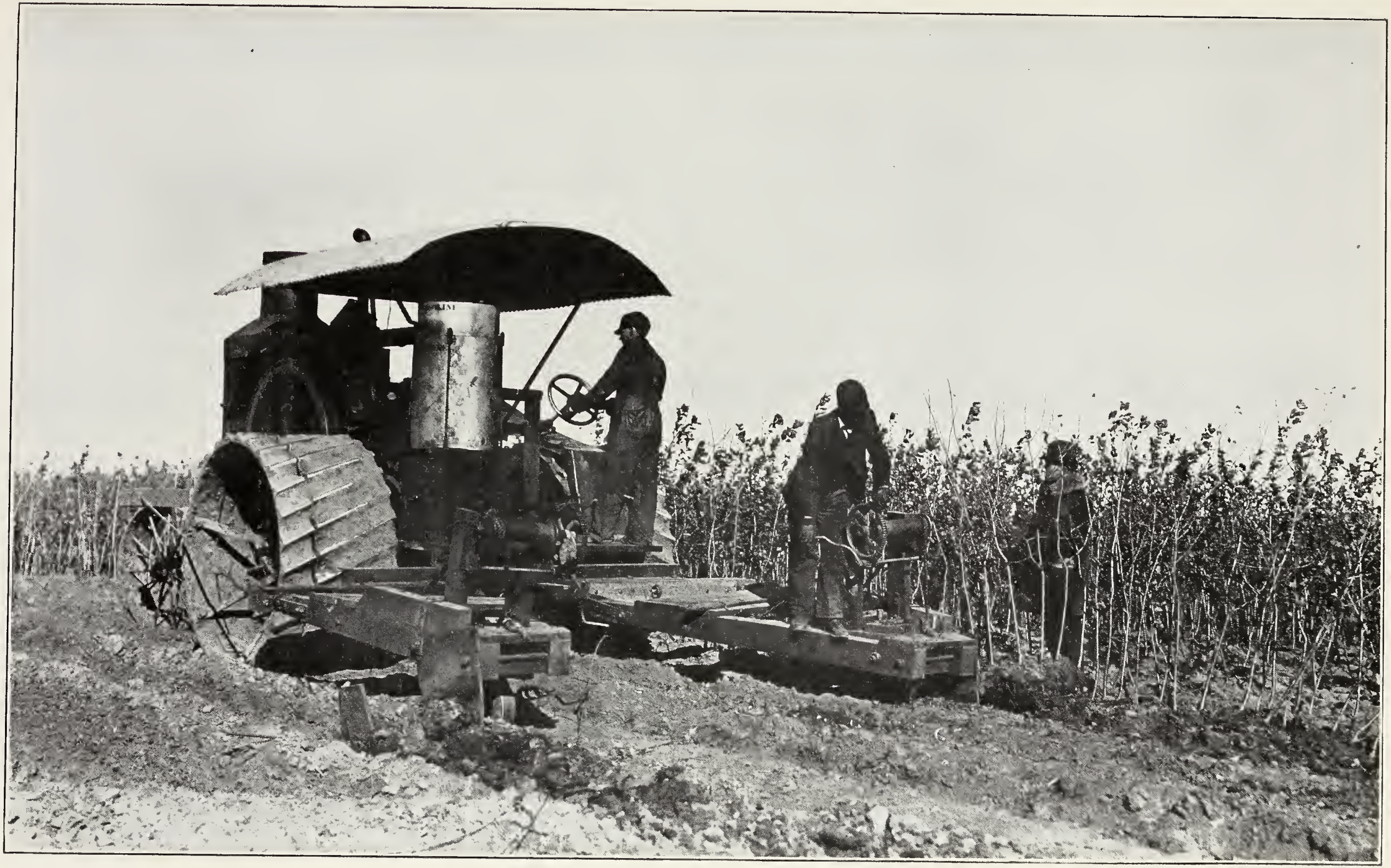
The coming year, the imported nursery stock to be planted out, of course, will be inspected, as in the past, and the summer work, we hope, will be greatly helped by the fact that provision was made for more extensive field records and collections and closer co-operation with the various sections of the Division of Entomology. During the past year, only one nursery was found with nursery stock infested with San Jose scale. This stock had been imported from New York State and lined out. This nursery now has a modern fumigation house and fumigates all stock leaving the premises, besides thoroughly spraying with concentrated lime sulfur all trees near those which were found to be infested. This was the second nursery in which San Jose scale has been found in the last two seasons and provisions have been made in both cases to see that the scale was destroyed and all stock fumigated before leaving the infested nursery. In both these cases, the stock came from another state and was lined out in the nursery where it was later found. We have been trying to gradually build up the inspection work, so as not only to eliminate the possibility of the spread of pests from nurseries, but also to make a survey from year to year of the various counties in which are found old orchards most likely to be affected with some pest. Because of the fact that Holland stock is so very free from pests and arrives in such first-class condition, and that other states are not inspecting this stock, I should recommend that we do not inspect Holland-grown and inspected stock for greenhouse purposes, but the consignee should be advised to take every precaution to help us keep out the various pests by carefully saving all packing and refuse and burning same; also the boxes if they are made of old lumber; and carefully examining each plant for the brown tail nest or the gypsy moth egg mass. As before stated, we should be advised of the arrival and receive the number of cases and their identification number.

During the past season, the usual insect pests were in evidence, although the poplar beetle (**Melasoma scripta**) did not do as much damage as in former years, partly due to the seasonal weather conditions and partly due to improved methods of control which some of our nurseries employed.

A pest which has not been in evidence to any extent heretofore (found in nurseries in southern part of state previous to this F. L. W.), but which was very abundant this year, was the woolly aphis which was found on apple, mountain ash, hawthorn, and elm. The oyster shell scale is abundant in some localities, although it has apparently done no great amount of damage where found. It is easily controlled and should be exterminated. Plum and apple aphis were also abundant and the red-humped caterpillar on apple was found several times. The snowball and high bush cranberry in most cases were affected to an extreme extent with green aphis. The raspberry Byturus was, as always, very much in evidence, as were mites and aphids on boxelder. One or two cases of saw fly on blue spruce, both Kosters and Colorado, were reported.

The following list gives the record of the various pests and host plants which were found in nurseries during the last season:

- **On Apple**
  - Aphis
  - Buffalo tree hopper
  - Oyster shell scale
  - Red-humped apple-tree caterpillar
  - Round-headed apple borer
  - Saddle-back caterpillar
  - San Jose scale
  - Trumpet leaf miner
  - Scurfy scale
  - Woolly aphis
- **Ash (Green)**
  - Aphis
- **Ash (Mountain)**
  - San Jose scale
  - Woolly aphis
- **Boxelder**
  - Mite work
  - Aphis
- **Compass Cherries**
  - Red-humped apple-tree caterpillar
- **Currant (Red)**
  - Aphis
  - Saw fly
- **Elms**
  - Cockscomb gall
  - Aphis
  - Scurfy scale
  - Woolly aphis
  - San Jose scale
- **Grapes**
  - Phylloxera
  - Lilac borer
- **Plum**
  - Aphis
  - Black aphis
  - Curculio
  - Red-humped apple-tree caterpillar
  - Scurfy scale
- **Poplar**
  - Poplar beetle
- **Raspberry (Red)**
  - Byturus
  - Snowy tree cricket
- **Snowball**
  - Aphis
- **Spirea**
  - Aphis
- **Strawberries**
  - Leaf curler
  - Nematodes
- **White Pine**
  - White Pine blight (Aphid)
- **Willow**
  - Aphis
  - Poplar beetle



Digging trees with a Power Digger

PLANT DISEASES

- **Apple**
  - Cedar rust
  - Fire blight canker
  - Heart rot
  - Scab
  - Shot hole fungus
  - Tipburn
- **Currant (Red)**
  - Leaf rust
- **Currant (Black)**
  - Shot hole fungus
- **Grape**
  - Powdery mildew
- **Honeysuckle (Lonicera)**
  - Mildew
- **Lilac**
  - Mildew
- **Maple**
  - Tar spot, Maple
- **Plum**
  - Brown rot (on twigs)
  - Mildew
  - Shot hole fungus
- **Raspberries (Black cap)**
  - Anthracnose
  - Crown gall
- **Raspberries (Red)**
  - Anthracnose
  - Cane blight
  - Crown gall
  - Yellows (Bad)
- **Roses**
  - Mildew (Bad)
- **Spirea**
  - Mildew
- **Strawberries**
  - Leaf Anthracnose

FINANCIAL STATEMENT

Dec. 1, 1914, to Dec. 1, 1915.

Cash on hand	$1,850.10	
Appropriation for 1915-16	3,000.00	
		$4,850.10
Deputy Inspector's Salary	$1,383.30	
Clerk and Accountant	150 00	
Expert Assistants, Traveling Expenses, etc	338.05	
Miscellaneous (Apparatus, Office Supplies, etc.)	91.81	
Printing	29 25	
Telephone	10.00	
Traveling expenses of Deputy Inspector	1,187.15	
		3,189.56
Balance		$1,660.54

COLLECTIONS—NURSERY FEES.

Cash on hand Dec., 1914	$10.00
8 certificates issued to dealers (1915)	40.00
115 certificates issued to nurserymen (1915)	575.00
	$625.00
Oct. 6, 1915. Deposited as per State Treasurer's receipt No. 2883	$485.00
Dec. 2, 1915. Deposited as per State Treasurer's receipt No. 3063	140.00
	$625.00

Respectfully submitted,

F. L. WASHBURN,
State Entomologist.

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No. 33

The University of Minnesota

AGRICULTURAL EXTENSION DIVISION*

Special Bulletin No. 8

University Farm, St. Paul July 1916

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SOME INSECT ENEMIES OF CORN

By Warren Williamson, Division of Economic Zoology

COMBATING INSECT ENEMIES

The most important factors in the control of insect enemies of corn and other field crops are crop rotation, clean cultivation, and timely plowing. There are, of course, special cases which require special treatment, but we must rely principally on methods which can be carried on at small expense and which fit in with the ordinary farming operations.

To combat them intelligently, the farmer should know insect pests when he sees them and have a practical knowledge of their habits and life history. Familiarity with scientific names and other technical details is not necessary, but, as one writer has said, the farmer should have a "business acquaintance" with the insects which attack his crops.

DEC 19 1916

SYNOPSIS OF INSECTS AND INJURIES

Injuring Seed in Ground

Wireworms.—Slender, hard, wiry, shiny, brown or yellowish six-legged larvae, about one inch long. They gnaw or bore through the kernels.

Seed-corn maggots.—White, footless larvae about one-fourth of an inch long. They bury themselves in the seed.

Injuring Roots

White grubs.—Large, fat, white worms, or larvae, with six legs, a large brown head and stout jaws; body curved. They eat the roots of the corn.

Corn root-lice.—Bluish green lice, about one-sixteenth of an inch long, found on the roots. Many small brown or yellowish ants usually are found with them in the hills. They cause the roots to wither or become dwarfed, but do not eat them.

Corn root-worms.—Slender, white, six-legged larvae with brown head and neck and brown patch on the last segment. They burrow in the roots, and may be found by peeling or splitting the roots.

Injuring Roots and Underground Part of Stalk

Wireworms.—Previously described. They eat the roots or penetrate the stalk.

*State Entomologist's Circular No. 39.

~~Illinois State Laboratory of Natural History~~
Library

Injuring Plant above Ground

Cutworms.—Plump, smooth, greenish gray caterpillars, from one inch to two inches long. They usually work at night, cutting off the young plant close to the ground, and hide during the day in the soil or under cover near the injured plant.

Bill-bugs.—Hard, oval, black or clay-colored beetles having a long snout or beak. Usually they are found head downward on the stalk, which they puncture with the beak. When the leaf unrolls rows of holes are seen across the blade.

Grasshoppers.—Too well known to need description. They eat leaves, husks, and silks about the borders of the field, in summer or fall.

Ear-worms.—Brownish or greenish striped caterpillars. They eat the kernels.

Chinch bugs.—Black-and-white bugs, smaller ones red, found in large numbers on outer surface of the stalk or beneath the leaf-sheaths. Those on corn usually come from wheat after cutting. They leave the plant in a wilted or sickly condition from loss of sap.

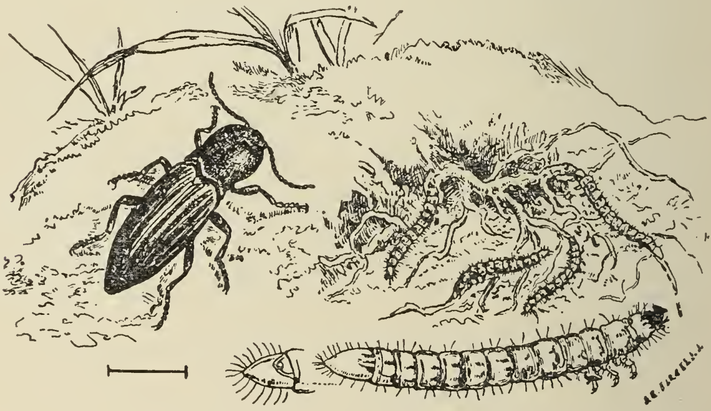

Fig. 1. Click Beetle and Wireworms (Brehm)

WIREWORMS

Wireworms often destroy the seed in the ground by boring into the kernel and frequently kill the young plants by eating the roots and by burrowing into the stalk. When full grown they are about one inch long, dark brown, and shiny, with a hard, smooth, jointed outer skeleton.[1] They wriggle and bend vigorously when held in the fingers. They have six jointed legs just behind the head and an additional proleg or prop on the last segment of the body. They eventually transform to the rather common medium sized, elongate, dark brown click beetles, so called because when placed upon their backs they spring into the air with a sharp, clicking sound.

Life History

The beetles come out of the ground early in the spring and lay their eggs in the soil, usually in grass lands. The eggs hatch into wireworms, which require at least two years to complete their growth. About midsummer of the year in which they become full grown they form little cells in the soil in which they transform to the pupal or resting stage and again change, three or four weeks later, to the adult beetles, most of which remain in the soil until spring.

Injury Caused

Wireworms do their greatest injury to corn when it is planted in newly broken sod land. While they are feeding on the abundant vegetation of grass lands the damage to the corn is seldom noticed, but when forced to concentrate on the comparatively few plants of a cornfield the effect of their work is soon apparent. The second year's planting suffers more than the first, because the grass roots in the soil which furnish food for many of the wireworms during the first season have decayed by the second season, forcing the wireworms to attack the corn.

Methods of Control

If old sod infested by wireworms is to be broken up, the plowing, followed by a thoro harrowing, should be done in the late summer or early fall. At this time the full grown wireworms are in the pupal stage, and are delicate and easily killed. If any of the beetles have developed they are sure to be in a somewhat helpless condition. In addition to killing some of them directly, the plow and harrow will turn many up to the surface and break their earthen cells, so that they will be exposed to the weather and to natural enemies. If hogs are allowed to run in the field before the plowing is done they will destroy many of the wireworms, as well as white grubs, cutworms, and other grass-eating insects. Clean cultivation and a short rotation will help to keep the pest in check. Small grain is injured less than corn by wireworms, while clover, peas, flax, and buckwheat are not injured at all.

If the depredations of wireworms make it necessary to replant corn it might be worth while to try the following method of treating seed recommended by the Massachusetts Agricultural Experiment Station,

Prepare a mixture of road dust and Paris green, using enough of the latter to give the mixture a greenish color. Put half a bushel of seed corn, or any amount convenient to handle, in a tub, and cover with water as hot as the hands can be held in. Dip a stick into tar, then stir it briskly in the corn. Repeat until the corn is black. Then take the corn out of the liquid and put it in the mixture of dust and Paris green already prepared. Stir the corn until all the kernels have a coating of the dust. When dry it is ready for the planter. It is claimed that this treatment will not prevent the germination of the seed and will repel wireworms.

THE SEED-CORN MAGGOT

The seed-corn maggot frequently destroys seed corn in the ground. It penetrates the kernel, killing the germ or the growing shoot and often hollows out the interior.

The full-grown maggot is about a quarter of an inch long. The posterior half of the body is nearly cylindrical and about as thick as a small pin head. The anterior part tapers to a point. The head is very small. The color is dirty white or yellowish. It has no legs.

Life History

After reaching its full growth the maggot becomes shorter and thicker, the skin hardens and becomes reddish brown in color, forming a barrel-shaped case about one-fifth of an inch long, in which the larva transforms to a pupa. From this stage it transforms to a fly which resembles a house fly but is smaller, being about one-fifth of an inch in length. It is brownish gray with black hairs and bristles.

Methods of Control

As injury often occurs where stable manure has been turned under, it has been suggested that the flies may be attracted to it to lay their eggs. Therefore it seems advisable to apply the stable manure the previous fall or long enough before

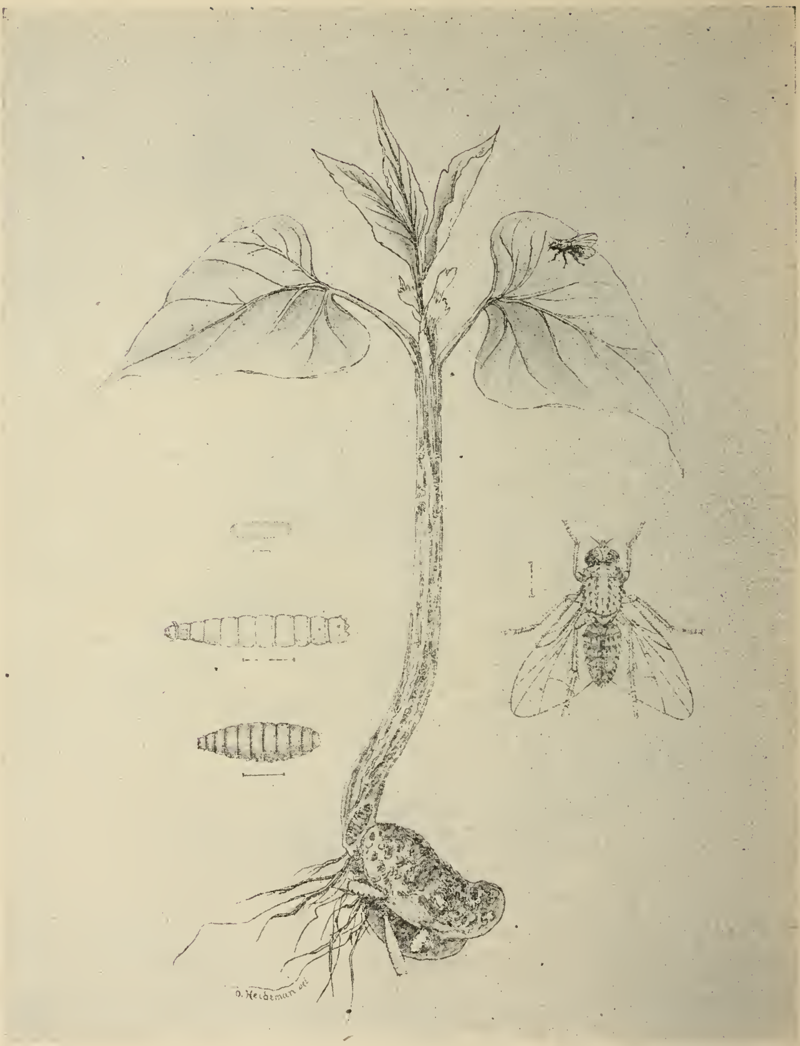
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Fig. 2. Seed-Corn Maggot on Bean (Lugger)

planting time to allow it to become well rotted. Rolling the soil after planting also has been suggested to keep the flies from the seed. If it is known that the soil is infested, injury might be prevented by treating the seed with tar in the same way as recommended for combating wireworms.

WHITE GRUBS

The injury to corn caused by the grubs eating the roots may only slightly retard growth, or, if much of the root system is weakened or destroyed, the stalk may be easily blown over.

Life History

The grubs may be found if they are there by examining the soil around and under the roots. They are thick-bodied, strongly curved, dirty white, from an inch to an inch and a half long. Most farmers recognize them, but perhaps many do not know that the grubs require at least two years to complete their growth, and that they eventually transform into the common brown May beetles, or June bugs, which fly about at night in the spring and early summer. The beetles feed on the foliage of various trees at night and hide in the soil during the day. The eggs are laid in the soil, preferably in grass lands, altho sometimes in cornfields.

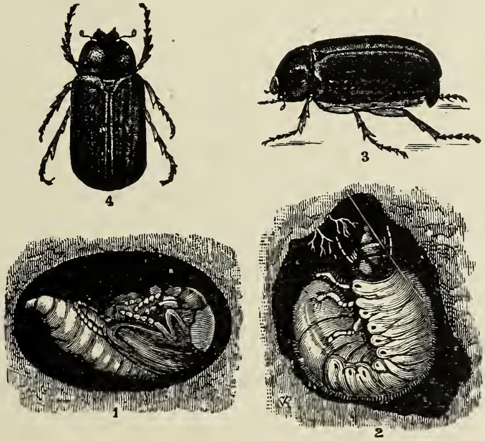

Fig. 3. White Grub, Pupa and Adults (Div. Ent. U. S. D. A.)

Methods of Control

There is no remedy that can be applied while the grubs are working on the corn, so one must use preventive measures.

Since grass lands, if allowed to run too long, furnish excellent breeding-places for white grubs, wireworms, and other pests, a system of rotation should be followed which includes clover, small grain, or flax, since these crops are not seriously injured by the grubs. Old sod land, especially if it is near woods, should be plowed in the fall. Hogs are very fond of the grubs and if allowed to root over infested fields will destroy great numbers of them. For this reason it is advisable to pasture hogs for a considerable time on meadows or pastures before plowing for corn, and the hogs should be allowed to run in the field while it is being plowed.

At the time of plowing the farmer can tell whether or not the land is badly infested. If thirty or forty grubs are turned out in a furrow a quarter of a mile long, the ground should be considered badly infested. If the land is found to be badly infested when plowed in the spring, it should not be planted to corn or any other hill crop.

Clean cultivation to keep down grass and weeds is recommended for preventing the beetles from laying their eggs in a cornfield.

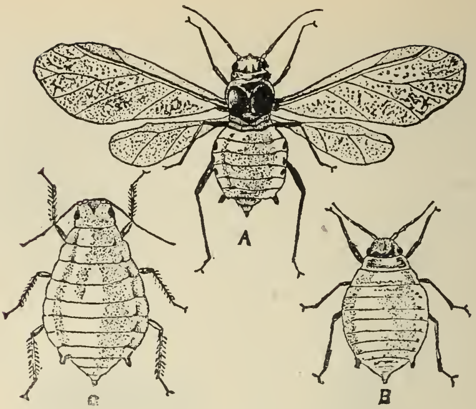

Fig. 4. Corn Root-Louse, Much Enlarged (Forbes)

THE CORN ROOT-LOUSE

The corn root-louse, or root-aphis, as it is sometimes called, is now recognized as a pest in Minnesota,.

If young corn plants on old corn ground are retarded in growth and unhealthy in appearance, and particularly if the burrows of ants are numerous in or near the hills, it would be well to examine the roots for lice which can be recognized by their small size, oval form, and bluish green color slightly whitened with a waxy bloom. They feed by sucking the sap from the roots and in this way rob the plant of nourishment. While the resulting injury may be slight, in many cases there is a partial or total loss over areas of half an acre each. Dry weather following the attacks of the root-aphis prevents the plant from recovering and increases the injury.

Life History

The eggs of the root-lice are cared for in winter by ants in their burrows in the cornfield. After hatching, the young lice are placed by the ants on the roots of smartweed or foxtail grass from which they are later transferred to corn. They breed very rapidly and as they become crowded on the roots of one plant they are carried by the ants to fresh plants. From time to time winged individuals are produced which fly to other parts of the same field or to other fields. There they are taken by the ants into the ground and placed on corn roots where they start new colonies. They secrete a sweet liquid upon which the ants feed.

Methods of Control

Since the corn root-louse works under ground it is out of reach of any effective method of treatment after it has attacked the corn. The corn grower must rely on prevention.

The injury is never severe except in ground that has been planted to corn for several years in succession. A short rotation in which the field is not planted to corn for more than two consecutive years will prevent the root-lice from gaining a serious foothold.

If it is necessary to plant corn on land that is known to be infested with root-lice, the ground should be plowed six or seven inches deep, and the soil thoroly stirred by frequent deep disking before planting-time. The plowing may be done in the fall or early spring, but the disking, of course, must be done in the spring. This treatment will break up the nests of the ants and scatter the eggs or expose them to destructive agencies. If any of the eggs hatch, the young will die unless the ants are able to take care of them, which is unlikely if the soil is repeatedly disturbed. Frequent cultivation will also destroy smartweeds, foxtail grass, and other weeds upon which the root-lice feed before the corn is up.

THE WESTERN CORN ROOT-WORM

Corn growing on land that has been in this same crop for several years in succession is sometimes injured by corn root-worms, which at first eat the smaller roots entirely and afterwards enter the larger roots, where they make longitudinal burrows beneath the outer layers. By peeling or splitting the roots one may often find the worm in the burrow.

In cases of slight injury the effect may be seen in the production of small ears. Greater injury is seen in dwarfed stalks or the absence of ears. If growing on rich loam the loss of the roots may cause the stalk to be blown over easily.

Life History

The worm, or larva, when full grown is about two-fifths of an inch long and one-tenth of an inch thick. It is white except the head, the top of the first segment of the body, and a part of the last segment, which are brown. Each of the first three segments behind the head has a pair of short legs.

After completing their growth the larvae abandon the corn roots and construct earthen cells in the soil in which they change to white pupae, and then, during August, to adult beetles. The beetles are at first yellow in color, afterwards becoming grass-green. They are about one-fifth of an inch long; and similar in size and shape to the common striped cucumber beetle. They may be seen during August and September feeding at first on the silks and pollen of corn and later on the pollen of various weeds and of clover, beans, squashes, and cucumbers. The eggs are deposited in the soil in corn fields and hatch the next spring.

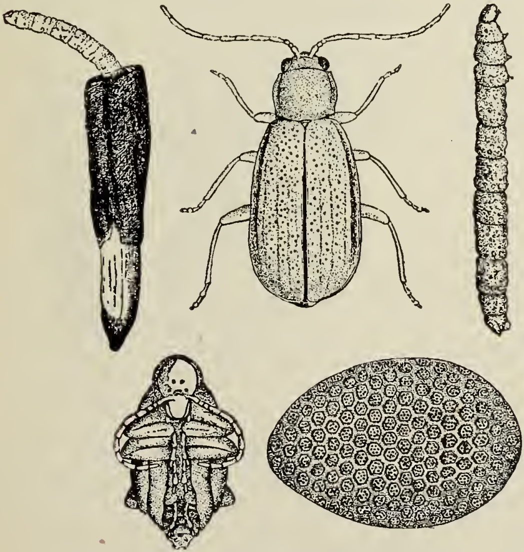

Fig. 5. Western Corn Root-Worm (Forbes)
Three stages, much enlarged. Egg much more enlarged. Corn root broken to show worm within.

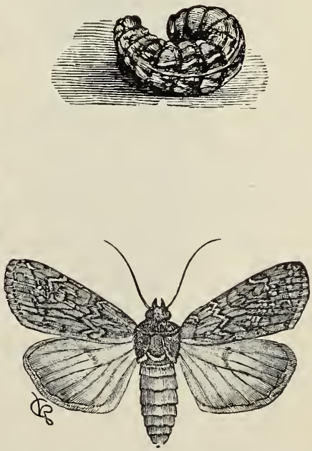

Fig. 6. Cutworm, Two Stages

Method of Control

The fact that the larvae feed only on the roots of corn makes it possible to starve them out by planting an infested field to some other crop the following year. If corn is not planted on the same land for more than two years in succession there will be no trouble with the pest.

CUTWORMS

There are several different species of moth whose larvae cut off young plants close to the ground, hence the name cutworm. There is some variation in the life history of the different species, but in general they do similar injury and the same methods of treatment can be applied to all.

Life History

The moths lay their eggs in midsummer in grass lands or places grown up in weeds. The larvae feed on the growing vegetation until cold weather when, being partially grown, they go into the soil to pass the winter. They come out in the spring and resume feeding. If grass lands, especially those of long standing, are plowed up and planted to corn, the cutworms, deprived of other food, will attack the young corn plants soon after they are up, cutting them off just above the ground. They feed at night and hide during the day. When full grown they are an inch and a half or two inches long, rather plump, and vary in color, being dull brown, gray, or black, sometimes tinged with green, either with or without obscure markings. Their dull color harmonizes with the color of the soil. They have three pairs of jointed legs just behind the head besides five pairs of short appendages called prolegs. When mature the cutworm forms a cell a few inches below the

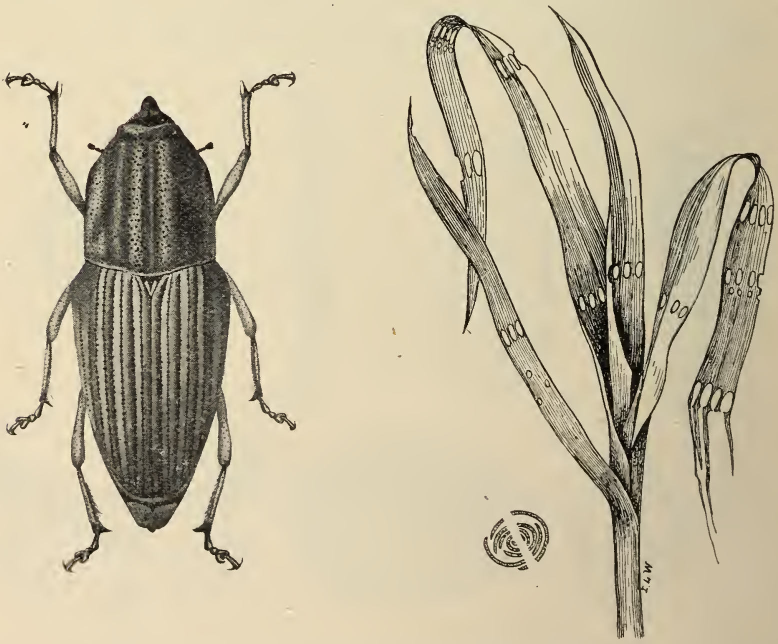

Fig. 7. Bill-Bug, Much Enlarged
Work of Bill-Bug

surface of the soil in which it changes to a brownish or reddish brown pupa. A few weeks later it changes to a grayish or brownish night-flying moth.

Methods of Control

Grass lands intended for corn should be plowed in midsummer or early fall. The earlier the plowing is done the fewer will be the eggs in the soil. Pigs pastured on such lands will root out and destroy many cutworms.

The use of poison bait a few days after planting is beneficial. The kind recommended for the control of grasshoppers may be used, with or without the fruit flavoring. It should be applied in the evening so that it will be moist when the cutworms feed at dusk.

BILL-BUGS

Corn bill-bugs are snout beetles. The largest of our species are clay-colored bugs about five-eighths of an inch long, while the smaller species are about one-fourth of an inch long and black. They often kill young corn, by puncturing the stem of the plant with the beak and eating its inner tissue.

Where bill-bugs are working in a cornfield many of the leaves have circular or oblong holes running in rows across the blade. Each row is the result of a single puncture made by the beetle when the leaves were rolled together in the plant. The injury may be very little, or it may be severe enough to cause a total loss of the crop over areas of several acres. In 1912 one Minnesota cornfield of twenty acres was destroyed by bill-bugs.

Life History

The beetles hibernate on the ground under rubbish or in other protected places and in the spring lay their eggs in or about the roots of rushes, sedges, or grass plants, which furnish food for the larvae. The larva is a thick, white, footless grub with a hard brown or blackish head.

If swampy land containing sedges, rushes, or large grass plants is plowed up in the spring and planted to corn the crop is almost certain to be attacked by the swamp-inhabiting species. If the vegetation is not kept down the first season by thoro cultivation, the injury will be repeated the second year. If timothy meadows of several years' standing are plowed in the spring and planted to corn there is danger of attack by the smaller species of bill-bugs, which inhabit grass lands.

Methods of Control

Late summer or early fall plowing of grass lands or recently cleared swamp lands intended for corn the following year will probably prevent a great amount of injury from bill-bugs. It would be safer, however, for the first year to plant some crop not attacked by bill-bugs, as flax or potatoes or garden truck. The burning over of grass and swamp lands infested with the beetles is also beneficial.

GRASSHOPPERS

Corn is sometimes injured by grasshoppers which come into the field from grass lands near by. They usually begin in the outer rows, eating the silks and kernels from the tip of the ear, the leaves, and sometimes even the husk of the young ear.

Methods of Control

The time to kill grasshoppers is in the spring, while they are without wings and before they have left the grass lands.

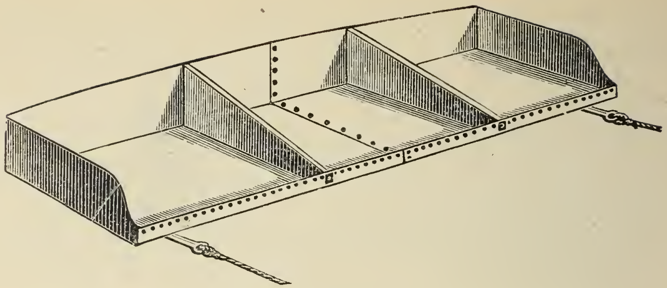

Fig. 8. Hopperdozer

The hopperdozer has been used for some time to catch grasshoppers in their wingless stages. This consists of a long shallow pan mounted on runners so that it can be drawn sidewise over the ground. The pan is partly filled with water and a small quantity of kerosene is poured on the surface of the water. Partitions may be placed in the pan to keep the water from slopping out. At the back of the pan is fixed a shield of canvas three feet high and this is wet with kerosene. The hopperdozer is pulled across the field by horses. The grasshoppers jump when it reaches them and are killed by coming in contact with the kerosene in the pan or on the shield. The hopperdozer is effective only after the grasshoppers are big enough to jump into the pan and before they can fly.

Poison Sprays.—Grasshoppers may be destroyed by a sweetened poison sprayed on the grass which serves as their first food. The spray should be applied as soon as the hoppers are hatched. Delay may prove fatal as they often move very quickly into the crops, where it is not so easy to carry out repressive measures. Promptness of action means saving of time, labor, and money, because the work

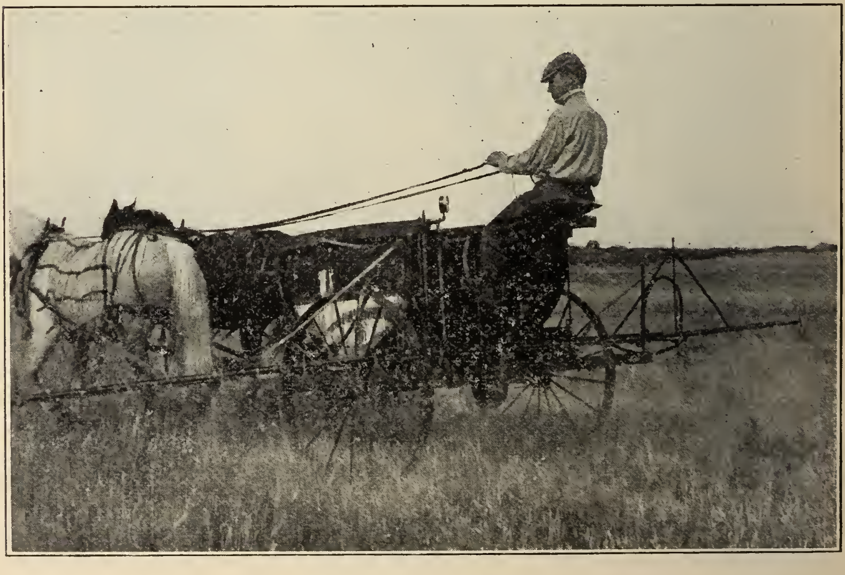

Fig. 9. Field Sprayer

can be done on a comparatively small area with the same eventual results. The spray is made as follows:

		Smaller amounts	
Sodium arsenite	3 lbs.	1 lb.	4 oz.
Water	180 gals.	60 gals.	15 gals.
Molasses	1½ gals.	2 qts.	1 pt.

Any spray pump can be used, altho the field sprayer is best. The spray should be applied in the form of a fine mist, early in the morning, before the 'hoppers feed, leaving the grass and weeds with a dewlike covering of the solution. If the area is small it should be entirely covered with spray. If large, a border from 2 to 4 rods wide around the exterior may be sprayed, and also several strips through the field, checker-board fashion. Grasshoppers are extremely fond of sweet substances, and are sure to eat grass or other plants covered with this sweetened poison.

Effective spraying must be done as soon as the grasshoppers hatch, while they are still very small, say a quarter of an inch long, as they soon move away from their nursery areas.

Poison Bait.—Another remedy for grasshoppers, known as the Kansas mixture, consists of a poisoned bran mash flavored with fruits, preferably oranges or lemons. An amount sufficient to cover five acres is made as follows:

Bran or shorts	20 lbs.
Paris green (or sodium arsenite)	1 lb.
Syrup	2 qts.
Oranges or Lemons	3
Water	3½ gals.

The fruit should be chopped fine and the bait scattered broadcast over the field where the grasshoppers are. It is best to do this in the early morning. Two or three applications may be necessary. The bait is attractive to the insects while it is fresh but is not eaten after it becomes dry and stale. It should not be spread just before a shower, as rain washes out the poison. If it is scattered evenly and thinly in small pieces there is probably no danger of poisoning birds or domestic animals. To be on the safe side it is advisable to keep stock and poultry out of the field for a few days.

Grasshoppers do not deposit their eggs in great numbers in well-tilled land. With increasing cultivation and the breaking up of reverted or raw lands the danger of grasshopper outbreaks is diminished. Fall plowing followed by thoro harrowing of land containing the eggs will help considerably.

THE CORN EAR-WORM

Damage is sometimes done to corn, more noticeably to sweet corn and popcorn, by worms, or caterpillars, working beneath the husks and devouring the young kernels still in the milky stage. In addition to the direct damage done and as a result of it, fungous growths gain a foothold and destroy much more of the ear.

The worms are about an inch and a half long when full grown. They are variable in color,—green, rose color, or dark brown—and are spotted, striped, or plain. The most common form is pale green with longitudinal white or gray stripes. They come from eggs laid by a moth which is about three quarters of an inch long, with a wing expanse of about one and three-fifths inches. The moths vary considerably in color. Most commonly the front wings are pale clay-color or olive-green with darker markings. The hind wings are pale with a blackish band on the margin.

Most of the eggs are deposited on the silks where the young caterpillars begin to feed and where they have easy access to the ear. When full grown they leave the ears and enter the soil where they change to the pupal, or resting stage, transforming later to moths.

Methods of Control

The remedy usually recommended for localities farther south is late fall plowing and thoro harrowing to kill the hibernating pupae in the soil, but as the insect is not yet know to survive the winter in Minnesota, it is uncertain whether or not the fall plowing in this state would be time and effort wasted as far as the corn earworm is concerned, altho benefit would be derived in the destruction of cutworms, grubs, etc.

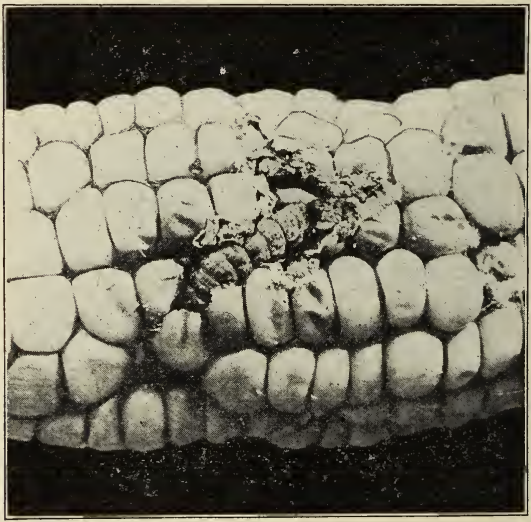

Fig. 10. Corn Ear-Worm

Recent work at the Kansas Agricultural Experiment Station demonstrated the value of dusting the silks with dry arsenate of lead. A mixture of 63 per cent of arsenate of lead and 37 per cent of sulfur is just as effective as pure arsenate of lead, and is cheaper. The dust was applied by shaking from an ordinary cheesecloth bag. This was done every three days as long as the silks were fresh. While the cost of dusting would prohibit its use where corn is raised in large amounts, the workers at the Kansas station recommend the treatment as profitable on corn raised for show purposes or for seed or table use.

THE CHINCH BUG

The chinch bug as a serious pest is usually active farther south than Minnesota, but, as there have been outbreaks in this state, there is no reason to believe that we will always be exempt.

The chinch bug is rather small, the adults being one-fifth of an inch long or less, almost black in color with white wings folded across the body when at rest. The immature bugs, often seen with the adults, are smaller, wingless, and red marked with yellow, becoming darker as they grow older. This species should not be confused with the false chinch bug, which is about the same size but is gray in color, its young also being gray.

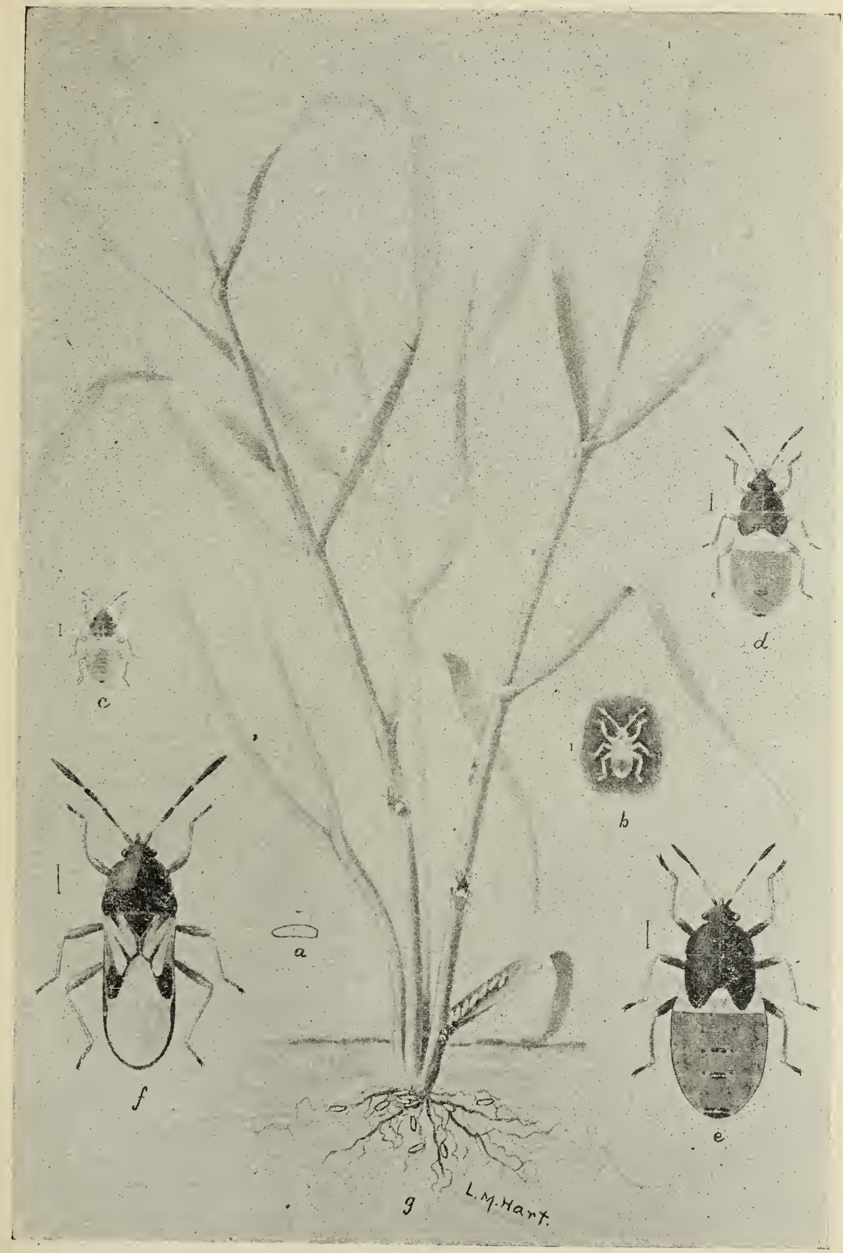

Fig. 11. Chinch Bug (Lugger)

The food plants of the chinch bug are the grains and grasses. They feed by sucking out the sap, and when present in enormous numbers they can rapidly drain a thrifty plant. During a serious outbreak they become excessively abundant in wheat until that crop is cut, when they migrate to adjoining cornfields.

Methods of Control

No effective remedy is known for chinch bugs while working in wheat, but cornfields can be protected from invasion if prompt and persistent action is taken.

In dry weather an effective barrier can be made by preparing a dust furrow around the field or on the sides threatened with attack. This is done by plowing several furrows and harrowing the ground thoroly to a fine mulch, then plowing a dead furrow through the middle and dragging this with a log, making the sides as steep as possible. Holes about a foot in depth should be made with a post-hole digger in the bottom of the furrow at intervals of about a rod to serve as traps for the bugs. The furrow must be continually watched and kept in repair with a hoe. The bugs exposed directly to the sun and struggling to climb out of the dusty furrow will be killed in great numbers by the heat while others will fall into the post-hole traps where they can be killed by kerosene.

Road-Oil Barrier.—A much better protection consists of a narrow line of coal-tar or road-oil. The road-oil is cheaper than the coal-tar and need not be renewed so often. To make a barrier, remove as much vegetation as possible from a narrow strip of land along the border of the field, then plow two deep furrows in opposite directions along the strip, throwing the dirt together to make a ridge. Make the ridge smooth and compact with a roller. Post-holes a foot or more in depth and about fifty feet apart should be dug in the edge of the ridge next to the field from which the bugs will come. Then pour a narrow line of road-oil or coal-tar (if road-oil is not obtainable) on the top of the ridge, making sure that it touches the edge of every hole on the side toward the corn-field.

This material may be poured from a watering-can with the sprinkler removed or from a coffee pot. The line should be at least an inch wide if road-oil is used. but may be narrower if tar is used. If it is kept fresh by occasional renewal and free from dirt and rubbish, the bugs will not cross it but will crawl along the barrier until they drop into the post-hole traps. It must be closely watched every day early and late as long as invasion threatens. Chinch-bugs on the outer rows of corn may be killed by spraying with a solution of cheap rosin soap using one pound of the soap to six gallons of water.

The importance of clean cultural methods cannot be too strongly emphasized. Most important is the destruction of hibernating places. Grass and rubbish where the bugs find winter cover should be raked and burned or otherwise destroyed. Neglected land along fences and the edges of woodlands may become the source of serious trouble.

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SPECIAL REPORT

OF THE

STATE ENTOMOLOGIST

OF

MINNESOTA

TO THE GOVERNOR

Work on the White Pine Blister Rust in Minnesota

1916

NOVEMBER 15, 1916

CIRCULAR NO. 40

ST. ANTHONY PARK, MINN.

LETTER OF TRANSMITTAL.

Agricultural Experiment Station,
St. Anthony Park, November 10, 1916.

His Excellency,
J. A. A. BURNQUIST,
State Capitol,
St. Paul, Minnesota.

Dear Sir: The unexpected work upon white pine blister rust called for this summer, and for which an emergency appropriation was made, appears at this time to warrant a Special Report to Your Excellency upon the work accomplished and expense involved. I herewith present, therefore, special report of the State Entomologist upon "Work on the White Pine Blister Rust in Minnesota, 1916," with the recommendation that it be printed as Circular No. 40 of the State Entomologist's Department.

Respectfully,
F. L. WASHBURN,
State Entomologist.

Approved:
J. A. A. BURNQUIST,
Governor of Minnesota.

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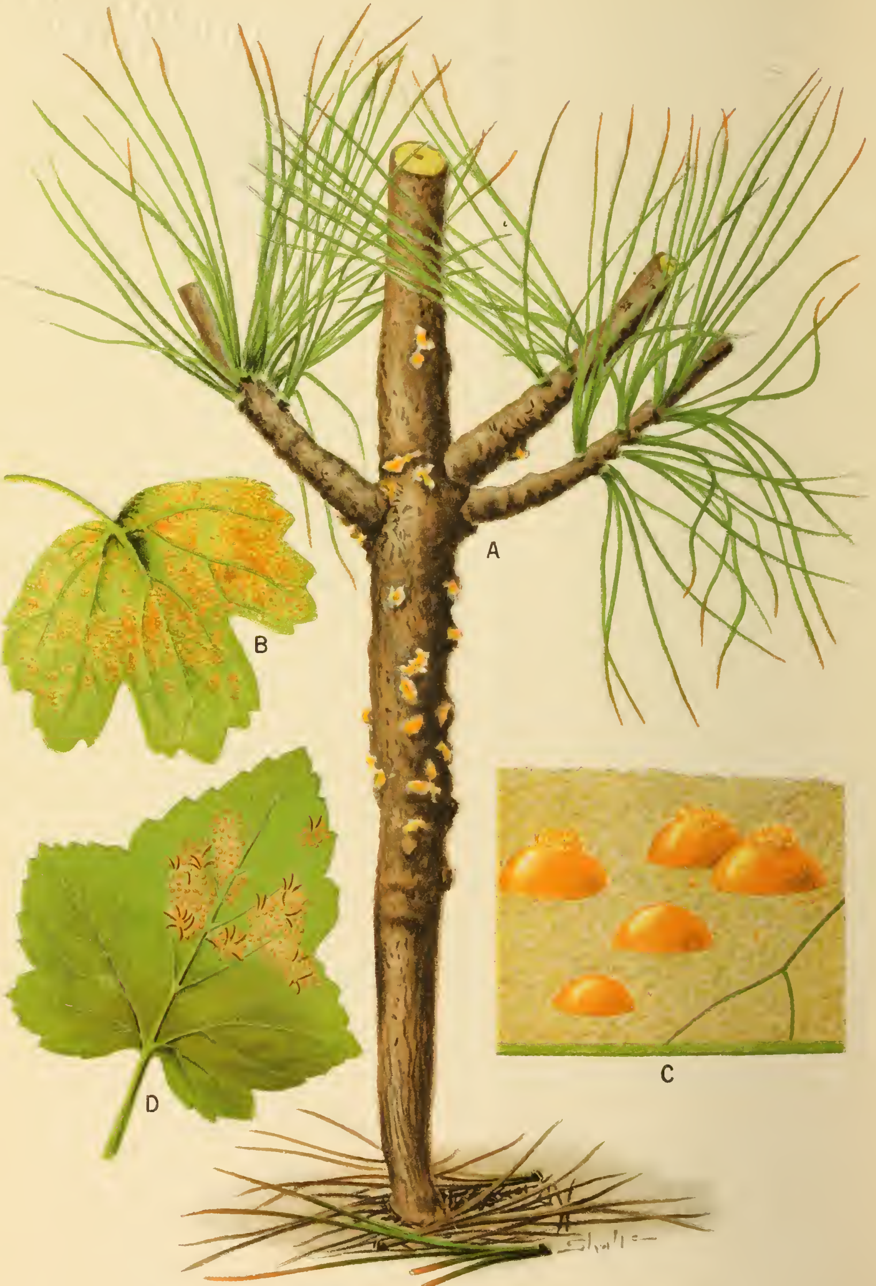

A.Hoen & Co.Baltimore

THE WHITE-PINE BLISTER RUST.

no. 40

WORK ON THE WHITE PINE BLISTER RUST IN MINNESOTA, 1916.

His Excellency,
J. A. A. BURNQUIST.

Dear Sir: As you are aware the State of Minnesota is unexpectedly threatened by a plant disease, which is a menace, not only to the white pine timber now standing, but also to the cause of reforestation, upon which we place so much dependence for our future welfare, as well as to all five leaf pines used for ornamental purposes in various parts of the state, particularly upon the estates in the neighborhood of our towns and cities. Another aspect in which we must view this unexpected infestation is that concerned with the nursery business and allied interests, since should this disease become widespread, a quarantine might be imposed upon all exports of certain shrubs and trees.

The disease referred to is known as the White Pine Blister Rust *(Cronartium ribicola* Fischer or *Peridermium strobi Kleb.)* This is a fungus parasite with two separate and distinct hosts, the white pine primarily and other five-leaf pines, limber pine *(P. flexilis)*, stone pine *(P. cembra)*, both found in varying abundance in Minnesota nurseries, and used thruout the state as ornamentals, as well as about seven other varieties occurring in various parts of America. The other host upon which it is found during the summer months is the genus *Ribes*, containing as now constituted, both currants and gooseberries, wild and cultivated. Details of this relationship in the life history of the fungus are given below. The disease is of European origin, and was imported into this country on pine seedlings as early as 1900 or earlier. In 1909 large numbers of these were brought to America. (U. S. Dept. of Agr. Farmers' Bulletin 742, Spalding.) The original home of this rust is said to be Eastern Asia or Serbia, spreading thence to England and northern and central Europe. The principal infestations in this country evidently came from Germany.

The foreign seedlings referred to above were widely distributed before it was known that they were diseased; New York, Pennsylvania, Connecticut, New Hampshire, Vermont, Massachusetts, as well as Ohio and Indiana received trees of this sort and in these states the rust

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EXPLANATION OF PLATE I.

A. Diseased white pine with blisters broken open, spreading the disease to any currants or gooseberries in the vicinity.
B. Early summer stage on lower surface of currant leaves, repeating on currant leaves or gooseberry leaves during the rest of the season, and a new crop of spores appearing every two weeks.
C. Early summer stage much magnified.
D. Late summer and fall stage on lower surface of a currant spreading the disease back to neighboring pines. Courtesy of Bureau of Plant Industry, U. S. Dep. of Agriculture.

became established. It is now (October, 1916) reported as occurring in New Jersey also. To prevent further introduction of the disease into this country the Federal Horticultural Board has forbidden (May 21, 1913) the importation of all five-leaf pines. This quarantine superseded that of September 16, 1912. It did not, however, quarantine any of the above infected states from which pines had been freely shipped, and currants and gooseberries are still allowed to enter the United States from Europe and other foreign countries. The entrance of these canes is doubtless permitted, because it has yet to be definitely established that the rust spores pass the winter upon them.

LOCALITIES IN MINNESOTA WHERE WHITE PINE BLISTER RUST IS KNOWN TO OCCUR.

In May a professor in Macalester College, St. Paul, Minnesota, submitted to the Experimental Station, a portion of a diseased pine coming from his farm in Polk County, Wisconsin. This was at once determined by our Plant Pathologist to be White Pine Blister Rust. Incident to a visit in the latter part of May to St. Croix Falls, Wisconsin, upon the part of members of the Plant Pathology Division and a member of the Nursery Inspection force, the disease was also found in a Minnesota nursery (which, to avoid personal reference we will designate as "Nursery A"), close to the St. Croix River, the proprietor of which had in the spring of 1915 obtained white pine trees at an old nursery in St. Croix Falls, Wis. This last named nursery had purchased these pines in one of two shipments, or in two shipments of trees from Germany, coming thru an Illinois firm in 1908-09.

Later, July 14th, two experts employed by the State Entomologist scouting for the disease along the banks of the St. Croix discovered its presence upon *Ribes* in the timber at Dry Creek, about 6½ miles above Taylors Falls, a mile or more from the St. Croix River, and approximately four miles from the above mentioned nursery designated as Nursery A. Previous to this finding it had been discovered (June 4th) by the Nursery Inspection force in a row of large pines about eighteen years old in a nursery forty miles or more south of the above infested locality. (This nursery may be designated as "Nursery B.") It was found on currants (uredospore stage) growing 75 feet from these infected pine on June 20th.

It is important to note at this point a fact which will be referred to later that, as a result of a most careful investigation by the inspection force upon pines in the early summer and later upon pines, currants and gooseberries no evidence of this disease has been found in other nurseries, and all primary infestations so far discovered occur within two miles of our eastern boundary. This is important in considering the possible source of Minnesota's infestation. Up to date this disease has not been discovered in this state west of the Mississippi River, except on a few pines shipped from Nursery A and destroyed before blisters appeared.

On September 25th, 1916, Mr. Coe, a field worker in connection with this disease, employed by the State Entomologist, and Mr. Salmon, working for the U. S. Bureau of Plant Industry, found in the course of a blister rust survey of the St. Croix reigon between Stillwater and Taylors Falls, a fourth "center" of infestation upon wild currants and gooseberries, close to the St. Croix at a point known as Pine Hollow Creek, three miles below Osceola on the Minnesota side. This discovery was made so late in the season that leaves were already falling and any attempt towards eradication would have been futile. Many of the pines at this point are undoubtedly now infested. This infestation appears most serious. It was first reported as covering an area of about thirty-five acres, but was later roughly estimated as covering fifty acres. Both here and at Dry Creek the deciduous growth is mingled with pines of various sizes. The latter place has a magnificent stand of large white pines, representing many thousand feet. In both localities pines, currants and gooseberries occur abundantly in ravines of varying width and length, and in these localities the disease was found most abundant. There appears to be a definite relationship between this abundance and the drawing of the wind up these miniature canyons. It is quite possible and even probable that further survey along the St. Croix will disclose the presence of the rust in other localities in that vicinity.

POSSIBLE SOURCES OF MINNESOTA'S INFESTATION.

While it is not possible at this date to state definitely the actual source or sources from which Minnesota obtained this disease, beyond, of course, the one introduction of diseased trees by Nursery A in the spring of 1915, certain facts point most strongly to the probability of its coming from Wisconsin. We know that diseased trees were brought to St. Croix Falls in 1908 or 1909, or in both years. It was a portion of these trees planted at Lake Waupagasset, Polk County, Wisconsin, which first called our attention to the presence of the rust so near our eastern border, and which this year (and previously?) infested a large area in the neighborhood of the above mentioned lake near the St. Croix.

The owner of Nursery B below Stillwater, in which the disease has probably been present for more than one year, claims that he has bought only seed from European sources, and that his pines for the past ten years have been of his own raising. The row of eighteen-year-old trees, upon which the blister rust was first found in that locality, was planted there when the nursery was first established fourteen or sixteen years ago, and so far, those in a position to know where the trees came from have claimed inability to state the source. The owner of Nursery A at Taylors Falls, as has already been stated, unwittingly brought some diseased trees from Wisconsin to his nursery in the spring of 1915. So far inspections of all other nurseries in this state have failed to disclose the rust.

These facts, and the further fact that we have only found the disease centers thus far along the St. Croix, in no case hardly more than two miles from the river and for the most part close to the river, points strongly to its introduction into this state from Wisconsin, and manifestly whatever we may do in Minnesota towards its eradication (and it is not assuming to state that all has been done that could be done this summer with the time and money at our disposal) will be futile, unless Wisconsin authorities feel the gravity of the situation and do their part in that state.

Both infestations at Dry Creek and Pine Hollow Creek, as well as that at Nursery B, have been discovered by experts in the Nursery Inspection Force, employed by the State Entomologist to scout along the St. Croix, covering the Minnesota side from the upper dam about twelve miles above Taylors Falls to Stillwater and below.

Wisconsin, to date, has made practically no similar survey of its side of the river, but has been content to give attention to eradication of pines, currants and gooseberries about Lake Waupagasset and to scouting in the region close to St. Croix Falls. On June 10th the Wisconsin Entomologist issued a quarantine notice, forbidding the entrance into that state of any five-leafed pine.

LIFE HISTORY OF THE WHITE PINE BLISTER RUST.

As above intimated this parasitic disease cannot pass from pine to pine, but must go to currant or gooseberry and back to pine. It can, however, pass from currant to currant or currant to gooseberry, both species in the genus *Ribes*, or from gooseberry to gooseberry. It is transmitted from one host to another by means of tiny spores very much smaller than grains of pine pollen (a spore being hardly visible to the naked eye), which can be borne it is believed many miles by the wind. It occurs to us that other agencies which may aid in its

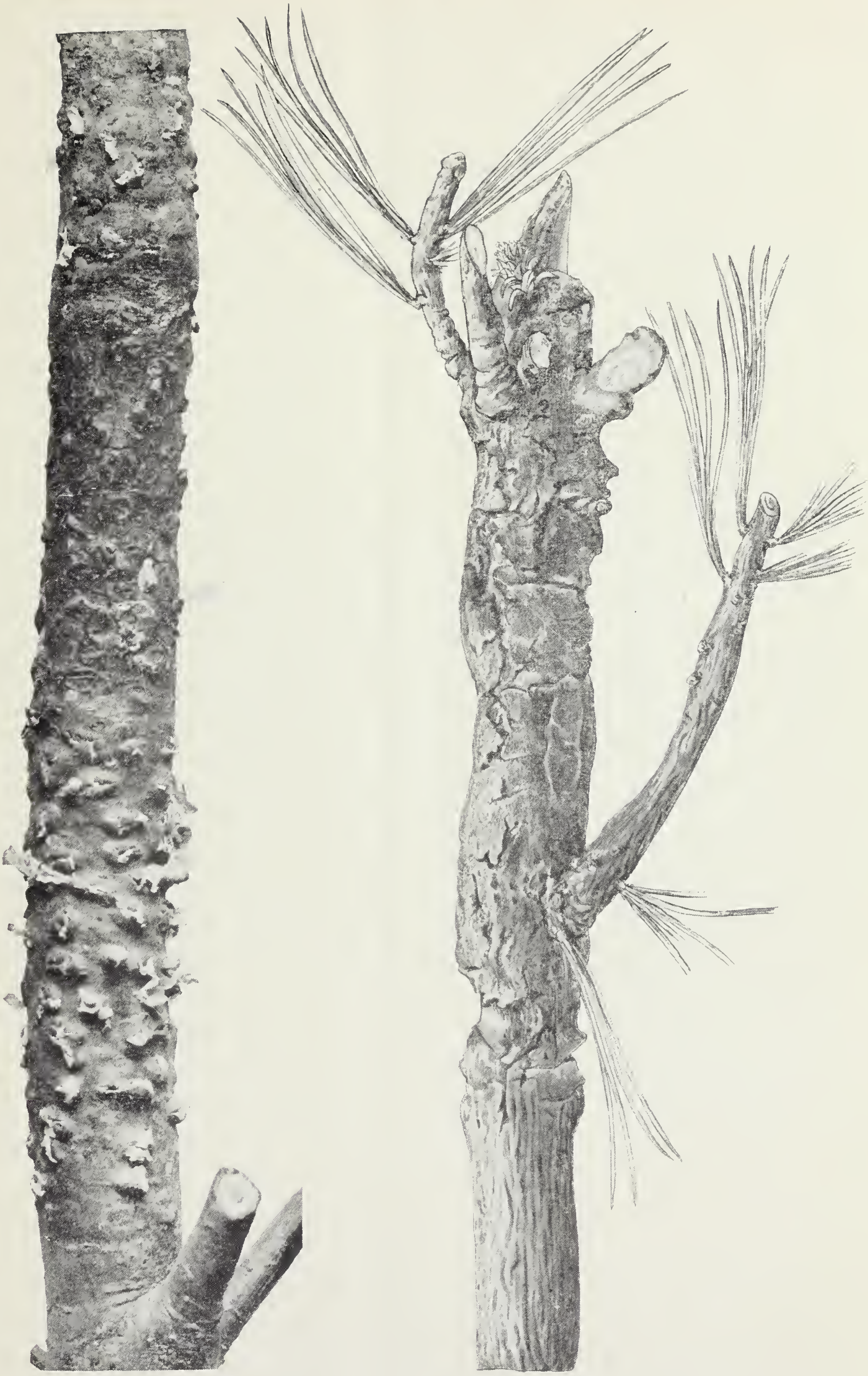


Fig. 1. On left: Branch showing fruiting of current year, and evidences of previous year's fruiting. Note the white membrane (blister) pushing out through swelling in bark. Courtesy of R. G. Pierce, Bureau of Plant Industry, U. S. Dep. of Agr. On right: Specimen of lower branch of *P. flexilis* nine years old, three feet high. Has evidently fruited at least once in previous years. Nursery B, July 28, 1916. Original.

dispersal are found in birds, various insects, cattle and other quadrupeds, as well as man himself.

During May (perhaps also in April) June and early July in Minnesota open and closed blisters may be seen on twigs or large branches or even on trunks of five-leaf pines. The presence of these blisters, white just before opening and about one-quarter inch across, and more or less elliptical in shape, is accompanied by a swollen, unnatural appearance of the bark of the tree on the affected portion. Blisters, which have opened, disclose the yellowish or orange spores (peridermium spores) within. These after a few weeks are disseminated, those reaching the leaves of currants and gooseberries starting upon the under side of the leaves, if the weather is not too dry the second stage in the life history of the fungus, attacking the leaves by sending tiny root-like processes into the living tissue and later developing very small yellow masses of spores on the under side. These spores are called uredospores; they are spread by the wind and probably by some of the other agencies mentioned above, infesting other leaves upon the same bush or upon other bushes. This form of reproduction continues during a large part of the summer, and in this way the disease may spread long distances if currants or gooseberries, wild or cultivated, are abundant. During June and July one finds present uredospores. Late in July (July 22nd was our first date at Dry Creek) another stage is found upon the leaves of affected *Ribes*. The spores in this latter stage are present until Autumn, being known as "teliospores." These cannot reinfect currants or gooseberries, but must go to the bark of pines in order to continue the life of the parasite. As before stated, the disease may remain dormant, or at least not visible on pine for from

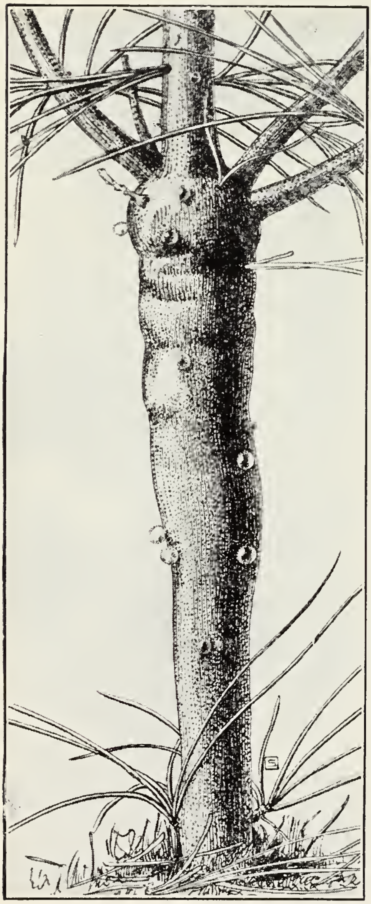


Fig. 2. Young white pine showing swelling and pycnidial drops of liquid caused by blister rust. Bureau of Plant Industry, U. S. Dep. of Agr.

two to six years, or possibly longer, hence, its occurrence in any state is no reflection upon the work of inspection officials or plant pathologists. The bodies producing teliospores looking like tiny threads less than one-quarter inch long, grow in clusters on the underside of the leaf and are easily visible with a lense. A tree attacked by these spores after a time exhibits a swelling of the bark at the diseased portion, generally losing its natural green color. Very early in the spring, and frequently at other seasons a clear liquid exudes in drops from this discolored bark. This liquid contains microscopic spores known as "pycnospores," the function of which is not readily understood. The appearance of these drops generally precede the appearance of the blisters.

After the peridermium spores are discharged from the blisters on the pines, said blisters remain as open cavities and the bark in the vicinity dies, exhibiting later a cracked and discolored appearance and showing evidence of a cancerous growth. The region about the blister may in fact exhibit "canker" of some sort during the period of spore discharge or before. This was clearly evident in the case of our first finding in Nursery B. If the tree is not killed immediately by the attack, and a large tree may not be, it may give off spores every year thereafter to infect currants and gooseberries in the vicinity. It is not known that spores live over winter on currant and gooseberry; so far most of the evidence would indicate the contrary. It has been generally supposed that if all currants and gooseberries within a radius of 1,500 feet from an infested pine or pines were destroyed, the danger of the infection spreading would be eliminated, but this year's observations indicate that this is possibly an unsafe assertion.

The life history of this parasitic fungus has been given very briefly, but we believe sufficient data have been presented to make it clear what a difficult problem is before us, if we wish to eradicate it in Minnesota, and how impossible the solution of this problem is unless neighboring states offer efficient co-operation for their own protection, as well as for the protection of this state.

WORK DURING THE SUMMER AND AUTUMN OF 1916.

Immediately upon the discovery of the rust in the two nurseries above referred to, the State Entomologist, by the authority invested in his office, imposed a quarantine forbidding the sale and shipment of any five-leaf pines, currants and gooseberries from either of the above nurseries until the rust had been eradicated therefrom. Acting upon the advice of the Division of Plant Pathology of the Experiment Station and the Entomologist, owners of these nurseries voluntarily destroyed all pines known by them or suspected by them to be infected, and all currants and gooseberries upon the premises, whether infested or not, and whether occurring within the so-called 1,500-foot limit or outside of it. In Nursery B, where infested currants were found in addition to the affected pines originally discovered and 75 feet from the latter, the Entomologist's deputy continued to find infested branches on young pines in different blocks, exhibiting fruiting areas of this or previous years. Since danger of infestation from these pines in the present season was over at the date of the discovery, the blocks of pines containing same were left for destruction later. The names and addresses of all consignees receiving pines for the past six years, with size and variety of pine, were secured from the proprietors of these nurseries. These were designated as "leads," and most of them were followed either by the Entomologist himself or a deputy, or by employees of the Plant Pathology Division or of the Federal Bureau. The remainder will be handled next spring if any money is available for this work. When one understands that some of these leads, containing many trees, might take one to a nursery, from which, in turn, many of the same trees had been again sold, requiring further search, it will be realized that the task is not a small one. Suspected trees found by following these leads were destroyed by the owners, or by deputies with the owner's consent. Nurseries A and B were both plotted, and location and numbers of all five-leafed pines, gooseberries and currants were shown on maps.

A systematic inspection of all nurseries carrying pine was started early in the season, attention also being given in June, July and later to currants and gooseberries, as well as pines. No evidence of White Pine Blister Rust was found in other than the two nurseries mentioned. This inspection was quite apart from the regular annual inspection, which latter, this year, has been somewhat delayed on account of this emergency work. On July 7th the quarantine was raised from Nursery A, it having been shown to our satisfaction that all evidences of the disease, both on pines and Ribes had been eliminated from the nursery; all pines, currants and gooseberries upon the place having been burned.

The first conference upon the White Pine Blister Rust of Experiment Station authorities was held in Dean Woods' office, March 2d. At this conference representatives of the Minnesota Forestry Board, the Minnesota Forest Service, the Division of Horticulture and of Plant Pathology, the College of Forestry, and the State Nursery and Orchard Inspection Service were present. It was then unanimously resolved to strongly urge the Federal Horticultural Board to place a quarantine on shipments of five-leaf pines and Ribes from those states, known to be infested with White Pine Blister Rust. The conference further decided to send letters to all Minnesota representatives, as well as to the Secretary of Agriculture and the U. S. Forest Service, stating that we heartily approved the attempt of the Federal Horticultural Board to eradicate the White Pine Blister Rust, and urging the importance of passing H. R. No. 9802, if action had not already been taken.

Similar conferences were held at intervals during the summer. On June 20th, realizing that we were confronted with an emergency that we could not meet with the funds normally at our disposal, a committee consisting of Dean Woods, Dr. Freeman, State Forester Cox, R. G. Pierce of the U. S. Bureau of Plant Industry, and the State Entomologist, appeared before your Excellency, stating the existing conditions and asked for an emergency appropriation of $1,000.00 for the use of the Entomologist to enable us to carry on the work of survey and eradication. This request was granted by yourself and the other authorized officials. Your committee's resolutions at the time contained an intimation that if necessary more funds would be made available. The resolutions, which are here given in full, contained also the opinion of the committee that owners of trees and shrubs (nursery owners particularly referred to) who lose same thru necessary destruction should be reimbursed upon the basis of a proper appraisement of their value by a committee appointed for the purpose.

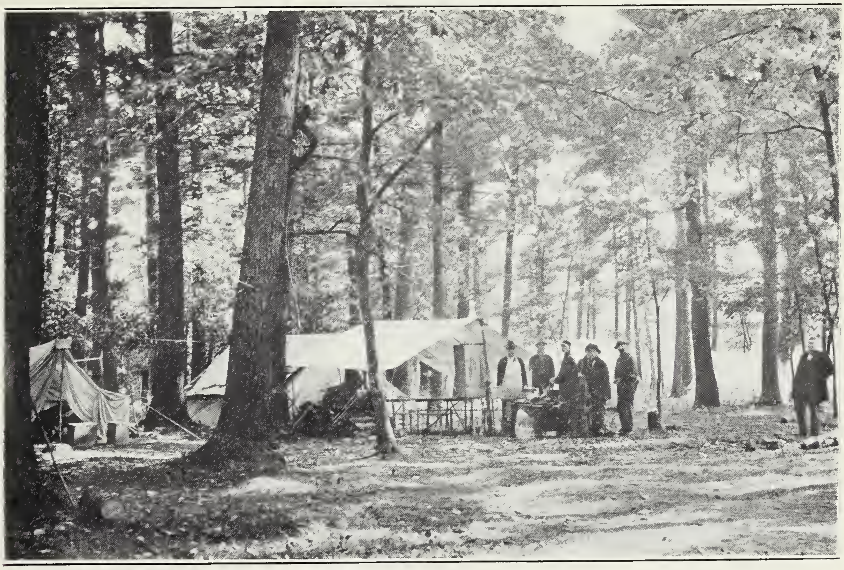


Fig. 3. A portion of our white pine blister camp on the St. Croix. Pines are more numerous in the locality than the picture indicates. Bartelt photo.

This referred only to stock not known to be diseased. At a meeting of our leading nurserymen with station authorities and later by a resolution of the Board of Directors of the State Horticultural Society, it was determined that such a committee should consist of a practical, conservative nurseryman, a representative of the Horticultural Division of the State Experiment Station, and the nurserymen who suffered said losses. Mr. John F. Andrews of Faribault and Professor Leroy Cady were chosen to act with the third party as above indicated in each case.

RESOLUTIONS PASSED IN GOVERNOR'S OFFICE, JUNE 20, 1916.

Whereas, the State Inspector of Nurseries has found a most dangerous plant disease taking root in Minnesota and that it must be immediately eradicated, and has for the purpose of work tending to eradicate said disease asked for the authority to incur not to exceed one thousand dollars ($1,000) expense prior to August 1, 1916;

Now, therefore, be it resolved, that it is hereby declared that the situation so reported by the State Inspector of Nurseries is a calamity, and we do hereby consent to the incurring of all necessary expenses by the said State Inspector of Nurseries in combatting and eradicating said disease, known as "white pine blister," to an amount not to exceed one thousand dollars ($1,000).

Resolved, further, that it is the sense of the undersigned officers of the State of Minnesota that, in harmony with an appraisement by a proper committee, the Legislature convening in the winter of 1916-17 be urged to properly compensate nurserymen and others who lose stock through its destruction for the purpose of stopping this calamity.

June 20, 1916.

(Signed)
J. A. A. BURNQUIST,
Governor.
J. A. O. PREUS,
Auditor.
A. C. GOODING,
Treasurer.

The Entomologist was fortunate in securing in the early part of the season the services of two good workers, Dr. Reynolds, Plant Pathologist, assistant Professor of Botany of North Dakota Agricultural College, and Professor Jensen, formerly a student in our own University and later a graduate student of Cornell. The discovery of the infestation at Dry Creek has already been mentioned and eradication work was instituted here with Mr. Rose and Mr. Badger having under them a force of laborers. These two men and laborers were part of the time on the payroll of the State Entomologist, and at other times on the federal payroll. Teliospores were found here for the first time on July 22d. While this eradication work was taking place at Dry Creek, a camp having been established there to facilitate the work, a survey of the river for twelve miles above Taylors Falls as far as the

Upper Dam was being conducted by Messrs. Reynolds and Jensen without discovering further infestation. This survey was conducted to and below Franconia. Later Mr. Harry Bartelt had charge of this camp, and did most effective work, outlining with accuracy, we believe, the boundaries of the infested area and supervising the eradication. Meanwhile, Mr. Maynard H. Coe, another employee of the State Entomologist having finished the work of supervising the destruction of stock and inspection of Nursery B, started a survey of the St. Croix below Stillwater as far up as Franconia. Thus, a complete survey of the Minnesota side was made from a point below Stillwater to Taylors Falls, and twelve miles above. Mr. Coe was later joined by Mr. Salmon, a temporary assistant of the U. S. Bureau of Plant Industry, and these men on September 25th discovered quite a large infested area at Pine Hollow Creek (in region known as Cedar Point), three miles below Osceola.

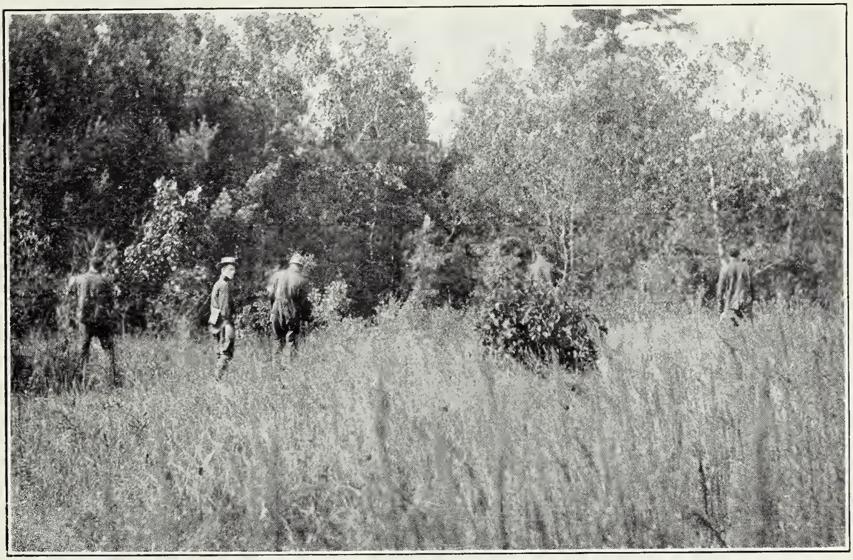


Fig. 4. Work of eradication. The four men in the background are equidistant from each other, each man ranging slightly behind the man on his right, and the right hand man following the (blazed) line. The party in the rear is checking up the work. Bartelt photo.

On September 5th your committee voted to allow the State Entomologist $300.00 additional upon his representation that further expense was necessary in order to eradicate all infested Ribes before frost. Had it not been for your cordial co-operation in this way, both on June 20th and September 5th, we would have been unable for financial reasons to co-operate effectively in this survey and eradication work.

About October 5th all field work stopped, heavy frosts causing the leaves on currants and gooseberries to fall.

Weekly reports have been filed in the Entomologist's office by the field men, and the writer or his deputy, or both, were frequently in the

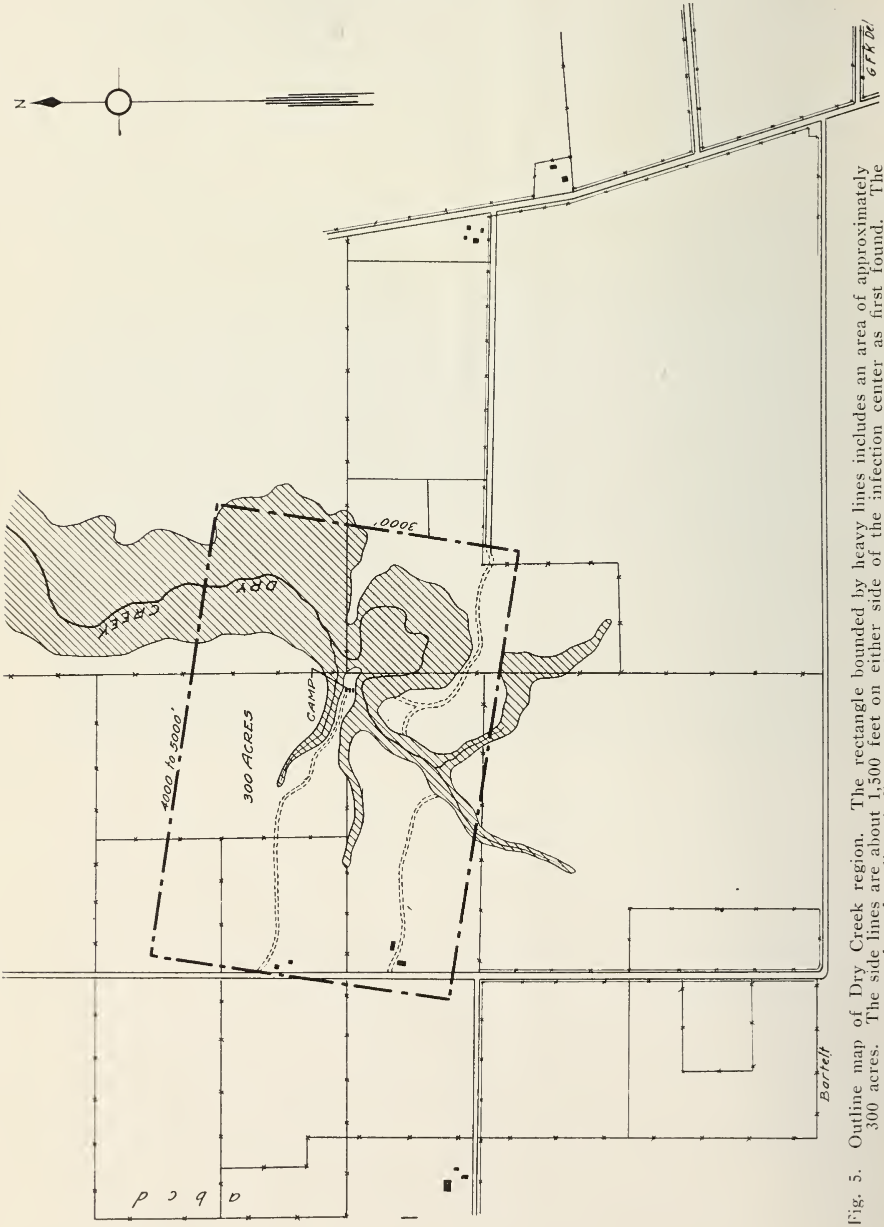


Fig. 5. Outline map of Dry Creek region. The rectangle bounded by heavy lines includes an area of approximately 300 acres. The side lines are about 1,500 feet on either side of the infection center as first found. The crosses on property boundary lines indicate extent of scouting activities. Late in the season infested Ribes were found in considerable abundance at a, b, c, d, a point far west of the infected center as originally located. Bartelt.

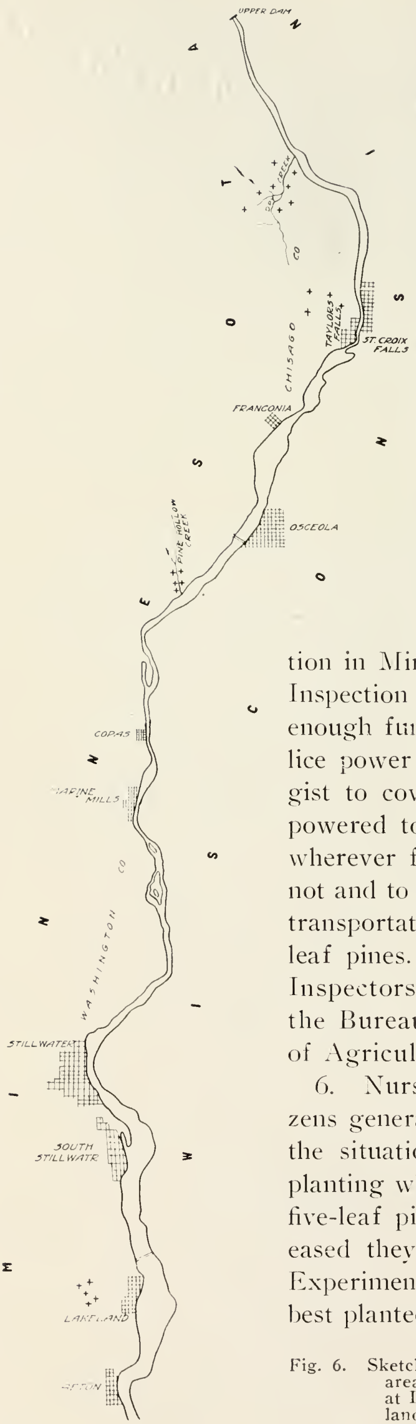
field. In getting to Taylors Falls and camp and return, as well as to the infested area at Lakeland and Pine Hollow Creek, the use of an automobile was found most advantageous.

It must not be concluded from the findings of the men this year that infestation does not exist in other localities on the St. Croix, for the hosts of currants and gooseberries along the river make it easily possible for infestation to be overlooked. Faithful survey work in this region for several years is necessary.

In eradication work the plan which appeared to give the best results consisted in running parallel lines thru the infested area some feet apart, said lines indicated by blazes or other marks. In these narrow lanes workmen uprooted all Ribes, placing the plants in piles for burning. Their work was closely followed by those in charge in an effort to see that no plant was overlooked. In a survey also to determine boundaries of an infested area the same general plans were followed, the lanes being wider. In this feature of the work the bushes were placed in piles by the workmen and then carefully examined by experts in charge. The evident limits of an infested area being found (Dry Creek Camp referred to), a "quarantine" area was outlined, including the infected area and nearly or quite 1,500 feet beyond the limits of infestation as found. At Dry Creek this included over 300 acres and it was over this acreage that the men attempted most faithfully to exterminate Ribes. Later the disease in this locality was found far outside of the area referred to.

SUMMARY AND FUTURE OUTLOOK.

1. White Pine Blister Rust is present in Minnesota, and has been found near our eastern boundary on pine and species of the genus Ribes. There have been discovered four points of infestation along the St. Croix River. Possibly, and probably, another year's survey will disclose other infested localities in the same region, i. e., along the river. One of the above "centers" is accounted for absolutely, diseased trees having been brought in from Wisconsin. With the exception of one or two leads from Nursery A (trees destroyed before blisters appeared) this rust has not been found in this state west of the Mississippi River. A careful inspection this year failed to disclose it in any Minnesota nursery, excepting Nursery A, and Nursery B (see above). It is to be noted that since it may not appear on the surface of a pine for some years after infection, it may be present on trees introduced directly or indirectly from Europe, or from some infected nursery in the United States, and owners of said trees be unaware of its presence.



2. From evidence at our command it would appear that these infestations came from Wisconsin (in the case of Nursery A this is an established fact).

3. Our state forest service estimates that there is approximately twenty-five billion feet of merchantable white pine standing in Minnesota, worth about twenty-five millions of dollars. Thousands of young white pine trees are annually planted in an effort to reforest our denuded timber lands. Is Minnesota willing to allow this menace to go unchecked?

4. The tardy development of this disease in pines makes the proposition of eradication a difficult one, calling for survey and inspection year after year for a long period.

5. As far as inspection and eradication in Minnesota nurseries is concerned, the State Inspection Service can handle the work, provided enough funds are available, but more extensive police power should be granted the State Entomologist to cover this emergency. He should be empowered to destroy all suspected trees and bushes wherever found whether the disease is apparent or not and to prohibit the entrance into Minnesota and transportation within this state of any of the five-leaf pines. This additional police power of State Inspectors is urged in a recent bulletin issued by the Bureau of Plant Industry, U. S. Department of Agriculture.

6. Nurserymen, Park Commissioners, and citizens generally should appreciate the seriousness of the situation and should refrain from buying or planting white pine for a number of years. If any five-leaf pines on their premises appear to be diseased they should communicate at once with the Experiment Station. Currants and gooseberries are best planted at a distance from five-leaf pines.

Fig. 6. Sketch of St. Croix River from Afton to the upper dam, the area covered by our survey on Minnesota side. Crosses at Dry Creek, Taylors Falls, Pine Hollow Creek and Lakeland mark the four affected localities found this summer.

7. In addition to nursery work, there should be a state wide survey of Minnesota to learn whether this disease occurs in sections other than those examined this year.

8. Any work towards eradication in Minnesota is futile unless Wisconsin, in which state the disease is known to exist, co-operates by continuous and efficient efforts at eradication within her own boundaries. This statement is also applicable to any other adjacent state in which the disease occurs.

9. Purchasers of stock from nurseries should realize that an Inspector's certificate is not a guarantee that pines in that nursery are free from White Pine Blister Rust, since as previously explained the disease may be present in the tissues of trees and not be apparent upon the surface.

10. *The relation of Nurserymen to the Federal Horticultural Board in connection with this disease.*

The Federal Horticultural Board in a commendable effort to save the five-leaf pines in the large area west of the Continental Divide have asked (not required, be it noted) nurserymen in Minnesota with those of many other states, not to ship pines, currants or gooseberries west of the Dakotas, and broadly speaking west of a line drawn south from those states. As State Inspector and collaborator with the Federal Board, the writer urges nurserymen to heed the suggestion coming from Washington, but expresses the hope that this request on the part of the Board may be modified. While the Board has prevented the introduction of five-leaf pines from Europe, it has placed no quarantine upon pines being shipped from the five or more states in the east known to be infested. Further, there is no restriction at present upon the entrance of currants and gooseberries into the United States from Europe. This unrestricted entrance of currants and gooseberries is probably permitted because so far practically all of the evidence as to spores being carried over on dormant bushes is negative. Such being the case and with the above facts before us, it would appear that dormant currants and gooseberries might be shipped with safety into the states, or portions of states lying east of the Divide, Eastern Montana, for example.

Personally, we should like to see all foreign importations of nursery and ornamental stock into the United States prohibited for a number of years. The White Pine Blister Rust was introduced and distributed before our citizens were aware of its presence. Other diseases as bad or worse might be brought in at any time, to develop later and cause thousands of dollars worth of damage. In this connection we quote from a letter received from J. G. Sanders, formerly State

Entomologist of Wisconsin, and now Economic Zoologist of Pennsylvania. The letter is dated October 23, 1916.

> "A short time ago I attended a gathering of State Inspectors of New England, New York and Pennsylvania at Fall River, Mass., where I went into the field and observed the work of the blister rust after about eight or nine years' standing. The destructive possibilities of the blister rust are truly amazing in these districts, where we found white pines five inches in diameter completely girdled, and branches up to twelve feet in length on old thirty- to forty-foot pines completely destroyed."

11. A conference to consider the necessary measures for the suppression of the White Pine Blister Rust in Minnesota and Wisconsin was called in Dean Woods' office October 28.

There were present: Dr. Haven Metcalf, head of office of Forest Pathology, Bureau of Plant Industry, U. S. Department of Agriculture; Dr. E. D. Ball, of the Wisconsin Nursery Inspection Service; Dean A. F. Woods; Dr. E. M. Freeman; Professor F. L. Washburn; Mr. D. P. Tierney, of the Minnesota Forest Service, and Professor E. G. Cheyney.

There were represented: The U. S. Department of Agriculture; the Nursery Inspection Service of Wisconsin; the University and Nursery Inspection Service of Minnesota, the Minnesota State Forestry Service and the Forestry Association. After an exhaustive discussion of the subject, all those present subscribed to the following resolution:

> Whereas, the white pine blister rust is a menace to our native white pine; and,
>
> Whereas, the disease is known to be present in Minnesota and Wisconsin; and,
>
> Whereas, the spread of this disease means the destruction of all future growth of white pine in these states; and,
>
> Whereas, the definite location of these infections is not known; therefore,
>
> Be it resolved, that the legislatures of Wisconsin and Minnesota be requested to make an adequate appropriation each year of the coming biennium for the purpose of scouting out the infection with a view to working out the best remedial measures.

For the next biennium, if the people of Minnesota desire the state to make an effort to eradicate this most destructive disease, men and money are necessary. The exact program and expense involved will have to be determined by a conference of officials and experts interested. It is safe to assume that an efficient survey and campaign of eradication will call for the expenditure of a large sum of money.

ACKNOWLEDGMENTS.

I take pleasure in expressing our appreciation of your co-operation, and at the same time that of the State Treasurer and State Auditor, which has enabled us to accomplish much more than would have been possible otherwise. We owe much to the co-operation of the U. S.

Department of Agriculture. The state is also indebted to Director A. F. Woods of the Experiment Station, who has done all that he could to urge the work to a successful end. To Dr. Freeman's council and advice as Plant Pathologist, we are also much indebted. A large part of the satisfaction felt at the end of the season has been due to the untiring efforts and interest shown on the part of George W. Peake, Deputy Nursery Inspector, who has not spared himself in directive work in the field. The specialists taking part in survey and eradication work have been mentioned in other parts of this report. We are particularly indebted to the Appraisement Committee, Messrs. Cady and Andrews, whose task has not been an easy one. Mr. Grover Conzet, formerly with the Minnesota Forest Service, has estimated for us the market value of the white pines at Dry Creek, and the Forest Service has borne a small share of the expense. The original drawing in this report was made by Miss Helen A. Sanborn.

FINANCIAL STATEMENT.

In addition to the two emergency appropriations of $1,000 and $300 respectively for the summer's work, it has been necessary to use over $1,000 of the State Entomologist's appropriation, which would normally go to regular inspection work; or to be exact, $1,026.72. In addition to this the Federal Government has co-operated thru the Bureau of Plant Industry to the extent of about $1,200.00.

WHITE PINE BLISTER RUST EMERGENCY FUND EXPENDITURES.

Emergency Appropriation, June 20, 1916		$1,000.00
Emergency Appropriation, September 5, 1916		300.00
		$1,300.00
Telegrams (to Federal Horticultural Board, etc.)	$9.29	
Salaries: Experts and Laborers (Reynolds, Jensen, Rose, Badger, Coe, Rafter and Booton)	681.01	
Circulars of Information and Colored Plates of White Pine Blister Rust for distribution	125.20	
Expense: White Pine Blister Camp, traveling and miscl.	454.82	
Mileage	29.68	
		$1,300.00

In addition to the above:

Money expended from State Entomologist's Fund	$1,026.72
Money expended by Bureau of Plant Industry, approximately	1,200.00

Small sums also from the Division of Plant Pathology of the State Experimental Station, and from the Minnesota Forest Service.

Respectfully submitted,

F. L. WASHBURN,
State Entomologist.

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No. 41

OFFICE OF
STATE ENTOMOLOGIST
ST. ANTHONY PARK, MINN.

CIRCULAR NO. 41
MARCH 24, 1917

NOV 27 1918

Entomologist's Report on Inspection of Minnesota Nurseries and Imported Nursery Stock for the Year 1916

Further Report on White Pine Blister Work in Minnesota 1916-17.

[redacted]
Library

LETTER OF TRANSMITTAL

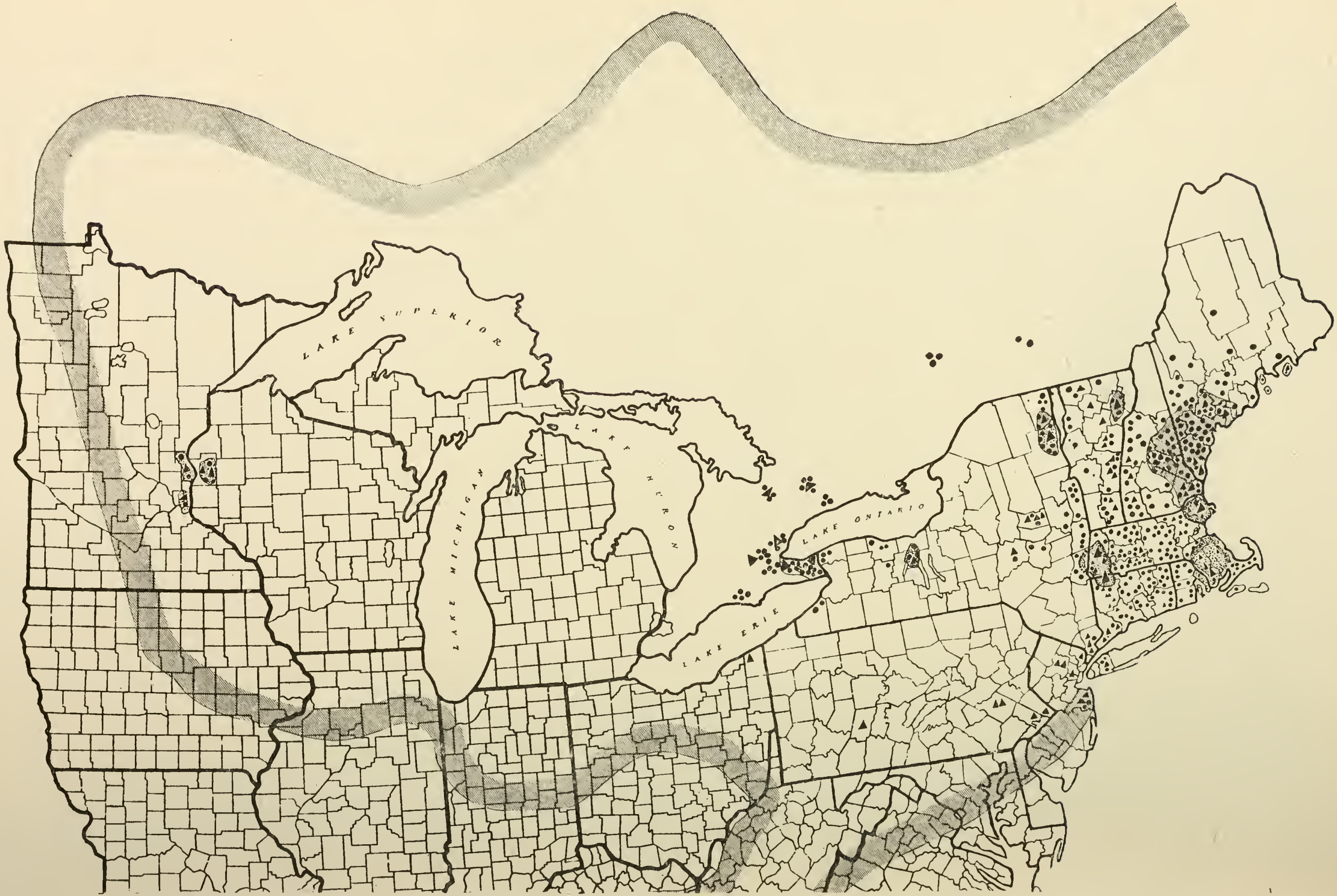
Agricultural Experiment Station,
St. Paul, Minnesota, March 21, 1917.

His Excellency,
J. A. A. BURNQUIST,
State Capitol,
St. Paul, Minnesota.

Dear Sir: I have the honor to submit to you herewith account of Nursery Inspection, season of 1916, and some further notes on White Pine Blister Rust work in Minnesota, with the recommendation that the same be printed as circular No. 41.

Respectfully,
F. L. WASHBURN.

Approved:
J. A. A. BURNQUIST.



MAP SHOWING INFESTATIONS OF WHITE PINE BLISTER RUST, AS FAR AS KNOWN IN 1916, IN THE UNITED STATES.

(Adapted from a New York State Circular)

EXPL. OF PLATE: Black triangles denote infestations of pines, circles those of currants or gooseberries. Shaded belt indicates limits of Eastern White Pine growth as far as incl[illegible]d in mapped area. Black circles in darker shaded portions indicate areas of heavily infected currants [illegible]d gooseberries. Dotted areas indicate centers of i[illegible]on where principal efforts were made to eradicate diseased plants.

OFFICE OF
STATE ENTOMOLOGIST
ST. ANTHONY PARK, MINN.

CIRCULAR NO. 41
MARCH 24, 1917

REPORT ON NURSERY INSPECTION IN MINNESOTA 1916.

FURTHER REPORT ON WHITE PINE BLISTER RUST WORK IN MINNESOTA.

On November 15th, 1916, Special Report on this disease was filed with the Governor. Since that date we have been enabled to compile a list of inspections for White Pine Blister Rust, and this list is included herewith.

PLANS FOR 1917 CAMPAIGN.

At a meeting held in Dean Woods' office, December 6, 1916, present: Dean Woods, E. M. Freeman, W. G. Brierly, E. G. Cheyney, A. F. Oppel (representing State Forester Cox), and F. L. Washburn, plans for further work of the Nursery Inspection and Plant Pathology Division were discussed. The Nursery Inspector claimed that the White Pine Blister problem in Minnesota was one directly connected with the State Forest Service, and as such should be handled by such service, citing as an analogous case the procedure of the Federal Government under similar circumstances. If a destructive insect threatens the federal forests, the Government enlists the U. S. Bureau of Entomology in the problem of eradication. If on the other hand a plant disease is the cause of the death of forest trees, the Bureau of Plant Industry is asked to co-operate. Since the White Pine Blister Rust is a plant disease, and the Minnesota forests and the cause of reforestration are threatened thereby, the Entomologist held that the State Forestry Service should undertake its eradication, the Plant Pathology Division of the Experiment Station co-operating, but that, in virtue of the existence of a State Nursery Inspector and state laws under which nursery inspection was carried on, that the last named official should have charge of the inspection for White Pine Blister Rust (and its eradication) in nurseries, parks, cemeteries, and private plantings. At Dean Woods' suggestion it was finally decided that Dr. E. M. Freeman, Plant Pathologist of the Experiment Station should have complete charge of the survey for and eradication of the disease in the timber and elsewhere along the St. Croix (including nurseries located in that region), and that the State Entomologist should assume responsibility of similar work in nurseries, parks, cemeteries and private plantings over the state, outside of the St. Croix Valley, as above outlined.

Two bills were prepared for presentation to the Legislature, one (later known as House File 513, Senate File 387) covered this special emergency, the other (known as Senate File 315, House File 601), intended to amend our present inspection law, under which the State Entomologist works, worded to include not only present conditions, but also to stand as a future protection for the state if any new insect pest or plant disease threatens the Minnesota Nursery industry or forests, or private or State plantings.

In the meantime the Governor recommended to the Legislature at the beginning of the session, that $25,000 be appropriated as an emergency fund for use in an effort to eradicate White Pine Blister Rust. This recommendation on the part of the Chief Executive is quite in line with similar progressive action on the part of officials in other states. Both of the above bills should pass. Senate File 315 has been amended to meet the approval of the nurserymen and the amended bill has been endorsed by representatives of the Minnesota Nurserymen's Retail Association. The bill, as we go to press, has been read once in the Senate and the amendments passed, and it is now awaiting final action. It depends entirely upon the legislature whether Minnesota is to make a fight against the disease or goes on record as preferring to take no action. It is a noteworthy fact that Congress passed an appropriation bill for $300,000 to combat White Pine Blister Rust in the last days of its session closing in March, at a time when other matters of great importance to the nation were pending.

During the fall and winter there have been several meetings of National Associations, which are directly concerned with this menace, namely: The Meeting of the National Committee for the Suppression of White Pine Blister, held at Albany, N. Y., November 20, 21, 1916; a meeting of the American Association of Horticultural Inspectors, of Entomologists, and an unofficial meeting of the Federal Horticultural Board, at New York City, December 26, 27, 28, 1916; and a meeting of the White Pine Blister Rust Committee and the American Forestry Association at Washington, D. C., January 18, 19, 1917. The Minnesota Entomologist was one of the delegates appointed by the Governor to attend the meeting at Washington.

We very briefly abstract the principal proceedings in the above meetings. At the Albany meeting, the committee declared itself in favor:

1. Of quarantining all plants from Europe, except such as were brought in by the U. S. Dept. of Agr.
2. Recommended a federal quarantine on Blister Rust along the western line of Minnesota, Iowa, Mississippi, Arkansas and Louisiana.
3. That the federal government appropriate not less than $240,000 for this work.
4. Each state to draft bills for White Pine Blister Rust to suit their own separate and several conditions.
5. That no compensation be made for diseased pines, diseased currants or wild currants or gooseberries.

Membership of the committee was enlarged to include four from each state. In Minnesota, State Forester Cox, Dr. E. M. Freeman and F. L. Washburn were designated representatives of the committee with the privilege of appointing a fourth.

At the New York meeting, on the evening of December 26th, there was an informal gathering of several of the inspectors and a few nurserymen at Hotel Endicott. Possibility of the United States quarantining all European stock was discussed. Nurserymen present expressed themselves unanimously as agreeable to such proposed action if fruit stock was not included. They preferred to buy seedlings for root stock from abroad.

December 27th: Combined meeting of the Phytopathologists, Nursery Inspectors and Federal Horticultural Board. Dr. Marlatt in the chair. Dr. Metcalf stated the situation in general. Mr. Washburn gave a detailed account of the situation in Minnesota. Mr. Ball discussed the situation in Wisconsin. Discussion of the possibility of spores wintering over on currants. Chairman ruled that there appeared to be a consensus of opinion that the shipment of dormant currants and gooseberries with the knowledge at hand was unsafe. No vote, however, upon this was taken.

In the afternoon the Minnesota inspector, together with a few nurserymen, met informally some of the members of the Federal Horticultural Board at Hotel Belmont. At this time a proposed amendment giving further powers to the Federal Board was discussed.

December 28th: Evening meeting of Nurserymen and Horticultural Inspectors in the American Museum discussed certain criticised features in inspection laws of some of the other states. This meeting accomplished one good result, namely, that of getting both nurserymen and inspectors to think over their mutual relations.

Washington Meeting, January 18-19, 1917.

At the meeting of the National Committee for the suppression of White Pine Blister Rust there was discussion of the proposed federal bill to exclude all foreign importations of nursery stock and ornamentals, with some exceptions. Mr. Pitkin, representing the nurserymen, criticised some features of the proposed bill, and action was postponed to give nurserymen and florists an opportunity to present their views.

The Minnesota Entomologist secured by unanimous vote of the committee endorsement of bill (now known as Senate File 315), to amend the Minnesota Horticultural Inspection Law.

One afternoon session of the American Forestry Association was devoted to consideration of White Pine Blister Rust.

LEGISLATION TO CONTROL WHITE PINE BLISTER RUST AND OTHER PLANT PESTS.

Several measures are at present before the Legislature, all planned to be of service in combating the White Pine Blister Rust. House File 477 is an appropriation bill for work against this disease. Senate File 315, House File 601 represents an amendment to our present inspection law, enabling us to handle not only the blister rust situation as it exists in Minnesota today, but also to act in similar emergencies in the future. It has been indorsed by the National Committee for the Suppression of White Pine Blister Rust in America, and, as amended, by representatives of the Minnesota Retail Nurserymen's Association, and other bodies. It is at present in the Agricultural Committee of the Senate and the appropriation bill above mentioned is before the Finance Committee. It depends upon the decision of the latter committee and upon the passage of proper laws whether Minnesota will handle this problem as it should be handled or go on record as favoring no action. Massachusetts is asking for $60,000, and that sum is at this date reported out at conference. New Hampshire asked $28,000, Maine $20,000, Connecticut $15,000, New York, $30,000. Nevada has already quarantined against entrance into that state of all five leaf pines, currants and gooseberries from Minnesota and all points east of the Mississippi. Other western states will follow this action and the Federal Horticultural Board will undoubtedly place severe restrictions on Minnesota nursery trade, unless we show by prompt and vigorous action that we propose to handle this matter in an efficient way.

Two affected nurseries have suffered loss through efforts last summer to eradicate the disease. The proprietors of these voluntarily destroyed stock to prevent the spread of the Blister Rust, and in accordance with a resolution passed in the Governor's office on June 20, 1916, should be reimbursed upon a conservative basis for value of stock they destroyed. That part of the resolution bearing upon this is here given:

"Resolved further, that it is the sense of the undersigned officers of the State of Minnesota that, in harmony with an appraisement by a proper committee, the Legislature convening in the winter of 1916-17 be urged to properly compensate nurserymen and others who lost stock through its destruction for the purpose of stopping this calamity.
June 20, 1916.

J. A. A. BURNQUIST,
Governor.
J. A. O. PREUS,
Auditor.
A. C. GOODING.
Treasurer

In addition to the above, Senate File 387, House File 513 has to do with special conditions along the St. Croix. House File 1122, Senate File 857 prohibits for two years the entrance into Minnesota of any and all five leaf pines. This latter bill was referred in the Senate to the committee of Public Domain, and the house file to the Agricultural Committee.

All these bills should pass if Minneosta desires to take vigorous and effective action against the White Pine Blister Rust. The text of these bills is too voluminous to be inserted here, but such as become laws will be printed and distributed later.

Under the head of Senate File 857, House File 1125, we are asking for reimbursement of $1,200 spent in the White Pine Blister Rust emergency from our regular inspection funds; this to be available immediately after passage of the bill. If this cannot be secured by the latter part of April or before, the regular nursery inspection work for the season cannot be taken up until August 1st, which will mean delay, besides creating a deficiency in our nursery inspection funds.

INSPECTIONS FOR WHITE PINE BLISTER RUST, SEASON OF 1916, WITH NAMES OF INSPECTORS.

		Date		Number of	
Owner	Town	1916	Inspector	Ribes	Pines
O. M. Peterson	Albert Lea	June 3	Conzet, Peake	.....	100
O. M. Peterson	Albert Lea	Aug. 24	Washburn, Peake	.....	100
Martin Fridholm	Albert Lea	June 2	Peake, Conzet	.....	.....
Martin Fridholm	Albert Lea	Aug. 24	Washburn, Peake	.....	.....
Clarence Wedge	Albert Lea	June 3	Conzet, Peake	.....	10,000
Clarence Wedge	Albert Lea	Sept. 14	Peake	.....	11,000
E. C. Baker	Albert Lea	June 2	Peake, Conzet	.....	.....
W. H. Horton	Alexandria	Sept. 14	Valleau	Few	.....
State of Minnesota	Arago	Sept. 25	Conzet	.....	405,000
Ludvig Mosbaek	Askov	Sept. 11	Valleau	1,000	.....
C. F. Woodle	Austin	Aug. 24	Washburn, Weiss	.....	.....
J. M. Lindsay	Austin	Aug. 24	Washburn, Weiss	.....	.....
W. H. Day	Bald Eagle	May 30	Conzet	.....	.....
Tom Laudenback	Bagley	Sept. 4	Conzet	.....	.....
A. A. DeSmidt	Battle Lake	Sept. 13	Valleau	.....	.....
L. P. Anderson	Bemidji	Sept. 24	Conzet	.....	.....
T. W. Ingersoll	Buffalo	Sept. 13	Washburn	.....	.....
F. E. Cutting	Byron	June 12	Peake	.....	9,016
F. E. Cutting	Byron	Sept. 1	Peake, Wenzel	.....	9,000
N. N. Oslund	Cambridge	Sept. 18	Marcovitch	.....	.....
Peter Siverts	Canby	Sept. 29	Weiss, Peake	.....	.....
George F. Snyder	Canton	Sept. 13	Weiss	.....	.....
J. W. Beckman	Cokato	Sept. 20	Washburn	.....	.....
John Eklof	Cokato	Sept. 21	Washburn	.....	.....
A. L. and F. Lee	Cokato	Sept. 21	Washburn	.....	.....
Edw. W. Schuster	Crookston	Sept. 18	Conzet	.....	.....
Charles Sell	Delano	Sept. 20	Washburn	.....	.....
C. E. Roe	Duluth	Sept. 12	Valleau	.....	.....
T. W. Taylor	Eagle Bend	Oct. 13	Peake	.....	.....

Owner	Town	Date 1916	Inspector	Number of Ribes	Pines
Oscar Wick	East Grand Forks	Sept. 19	Conzet	300	12
A. Brackett	Excelsior	Aug. 15	Washburn	.....	.....
A. O. Hawkins	Excelsior	May 31	Conzet, Peake	5,000	100
A. O. Hawkins	Excelsior	Sept. 1	Washburn	.....	.....
P. M. Perry	Excelsior	Oct. 7	Washburn, Peake	.....	.....
C. P. Jackson Land Co.	Excelsior	Aug. 15	Washburn	.....	.....
Charles Hawkinson	Excelsior	May 31	Conzet, Peake	.....	.....
Charles Hawkinson	Excelsior	Sept. 1	Washburn	.....	.....
Mrs. N. S. Snyder	Excelsior	Aug. 15	Washburn	.....	.....
William Schmid	Excelsior	Apr. 18	Nelson	.....	.....
August Sauter	Excelsior	Sept. 25	Washburn	.....	.....
P. C. Christensen	Fairmont	Oct. 31	Peake	.....	.....
G. D. McKisson	Fairmont	Oct. 31	Peake	.....	.....
B. E. St. John	Fairmont	Mar. 19	Peake	.....	.....
John P. Andrews	Faribault	June 8	Conzet, Peake	.....	.....
John P. Andrews	Faribault	Nov. 5	Peake	.....	160
Brand Nursery Co.	Faribault	June 7	Peake	.....	.....
Brand Nursery Co.	Faribault	Aug. 19	Peake	.....	.....
William Kueker	Faribault	June 7	Peake	.....	535
William Kueker	Faribault	Aug. 16	Peake, Wenzel	.....	960
J. A. Bovey	Ferndale	July 10	Washburn	.....	8
O. A. Th. Solem	Halstad	Sept. 21	Conzet	.....	.....
Hughart's Sons	Hamel	Aug. 18	Washburn	50	400
William Sandrock	Houston	Sept. 12	Weiss	.....	.....
W. H. Eddy	Howard Lake	Sept. 20	Washburn	27,092	1,302
Dewain Cook	Jeffers	Sept. 30	Peake, Weiss	.....	.....
J. A. Mogren & Sons	Kenyon	June 9	Peake	.....	.....
J. A. Mogren & Sons	Kenyon	Sept. 1	Peake	.....	14
P. H. Volstad	Kenyon	Aug. 31	Peake	.....	.....
E. J. Hershang	Kenyon	Sept. 1	Peake	40	26
Jewell Nursery	Lake City	May 26	Washburn, Peake	.....	670
Jewell Nursery	Lake City	Aug. 22	Peake	.....	.....
		Aug. 23	Conzet	.....	.....
		Aug. 24	Nelson, Weiss, Wenzell	90,000	4,000
P. G. Johnson	Lake City	Aug. 22	Conzet, Peake	20	.....
J. L. Anderson	Lake City	Aug. 22	Conzet, Peake	9,065	439
Moseman Bros.	Lake City	Aug. 23	Conzet, Peake	.....	.....
G. A. Tolleson	Lake City	Aug. 22	Weiss, Peake	3,000	.....
L. L. May	Lakeland	May 27 and 28	Peake, Conzet	.....	1,550
L. L. May	Lakeland	May 29	Peake	....	1,200
L. L. May	Lakeland	June 12	Washburn	.....	.....
L. L. May	Lakeland	June 26	Washburn, Peake	.....	.....
L. L. May	Lakeland	June 28	Peake	.....	.....
L. L. May	Lakeland	June 30 to Aug. 21	Coe, Peake, Washburn	.....	.....
L. L. May	Lakeland	July 2, 3, 6, 7, 8	Peake	.....	.....
L. L. May	Lakeland	July 10	Washburn	.....	.....
L. L. May	Lakeland	July 15	Peake	.....	.....
L. L. May	Lakeland	Sept. 26 and 27	Nelson	.....	.....
L. L. May	Lakeland	Oct. 1	Coe	.....	.....
L. L. May	Lakeland	Oct. 21 to 24	Coe	.....	.....

		Date		Number of	
Owner	Town	1916	Inspector	Ribes	Pines
Ludwig Carlson	Lindstrom	May 30	Conzet, Peake	.....	622
Ludwig Carlson	Lindstrom	June 12	Peake, Conzet	.....	.....
D. Winter	Long Lake		Peake	250	525
Franc P. Daniels	Long Lake	Aug. 8	Washburn	.....	.....
George Tong	Long Lake	Aug. 8	Washburn	.....	.....
John P. Vikla	Lonsdale	Nov. 2	Peake	.....	.....
C. E. Older	Luverne	Sept. 30	Weiss, Peake	.....	.....
M. Soholt	Madison	Sept. 28	Peake, Weiss	3,000	.....
L. Z. Smith	Mankato	Oct. 27	Peake	.....	.....
W. E. Fryer	Mantorville	June 10 to 12	Peake	300	4,000
W. E. Fryer	Mantorville	Sept. 2	Peake, Wenzell	.....	.....
C. J. Orton	Marietta	Sept. 28	Peake, Weiss	.....	.....
.....	Marine Mills	Sept. 10 and 11	Peake	.....	.....
E. C. Eaker	Marshall	Sept. 29	Peake, Weiss	.....	.....
J. F. Brady, Sr.	Medford	Nov. 6	Peake	.....	.....
Grace Patten Eaton	Medford	Aug. 22	Washburn	.....	.....
C. B. Finsaas	Mildred	Sept. 27	Conzet	.....	.....
Harry Franklin Baker	Minneapolis	June 1	Washburn	100	150
Harry Franklin Baker	Minneapolis	Oct. 2	Peake	.....	.....
E. A. Farmer	Linden Hills Sts., Mpls.	June 6	Peake	.....	.....
E. A. Farmer	Minneapolis	Oct. 6	Peake	.....	.....
Mpls. Park Board	Lake of Isles Blvd.	June 3	Washburn	.....	8
	Glenwood Pk.	June 3	Washburn	.....	1,000
	Columbia Hts.	June 3	Washburn	.....	500
John Hawkins	P. O. Box 495 Minneapolis	June 2	Washburn	.....	20
John Hawkins	Minneapolis	Aug. 16	Peake, Nelson	15,000	200
C. C. Hunter	Minneapolis	June 7	Washburn	.....	112
C. C. Hunter	Minneapolis	Nov. 21	Peake	.....	.....
J. L. Teigland	Minneota	Sept. 29	Peake, Weiss	.....	.....
O. F. B. Gustafson	Mound	July 9	Washburn	.....	12
G. E. MacComber	Nemadji	Sept. 12	Valleau	.....	.....
James Arrowood	Nevis	Sept. 29	Conzet	.....	.....
J. O. Bailey	Newport	Sept. 21	Weiss, Marcovitch	.....	.....
William Pfaender	New Ulm	Oct. 1	Peake, Weiss	.....	.....
Jas. M. Punderson	Northfield	June 1	Conzet, Peake	.....	.....
Jas. M. Punderson	Northfield	Aug. 22	Washburn, Peake, Wenzel	2,000	100
Henry Dunsmore	Olivia	Sept. 26	Peake, Weiss	.....	.....
Thos. E. Cashman	Owatonna	Jun. 4-5	Peake, Conzet	100,000	25,000
Thos. E. Cashman	Owatonna	June 15	Washburn	.....	.....
Thos. E. Cashman	Owatonna	Aug. 25	Wenzel, Weiss, Conzet, Peake	.....	.....
D. M. Mitchell	Owatonna	June 2	Conzet, Peake	.....	.....
D. M. Mitchell	Owatonna	Aug. 27	Wenzel, Weiss, Peake	.....	.....
L. J. Wesley	Owatonna	Aug. 23	Washburn	.....	.....
Frank Brown & Sons	Paynesville	Sept. 15	Valleau	.....	.....
J. H. Bauer	Perham	Sept. 13	Valleau	.....	.....
R. E. Killmer and O. J. Graham	Pine City	Sept. 11	Valleau	.....	.....
Benj. Rochell and Geo. Benz	Pine Hollow Creek	Oct. 5	Washburn	.....	.....

		Date		Number of	
Owner	Town	1916	Inspector	Ribes	Pines
C. E. Snyder	Preston	Oct. 3	Weiss	800	3,000
H. W. Harrison	Rochester	Aug. 25	Washburn	.....	.....
H. W. Harrison	Rochester	Sept. 1	Peake	.....	.....
F. C. Erkel	Rockford	Aug. 18	Washburn	.....	.....
J. J. Hill	St. James	Oct. 27	Peake	.....	.....
J. C. B. Anderson	1285 Portland Av., St. Paul	May 20	Peake	.....	.....
C. B. Hoyt	Hoyt & Hamline Avs., St. Paul	May 31	Washburn	.....	12
C. B. Hoyt	St. Paul	Aug. 25	Nelson	.....	.....
Holm & Olson, Inc.	20 W. 5th St., St. Paul	May 31	Conzet, Peake	2,800	500
Holm & Olson, Inc.	St. Paul	June 6	Peake	.....	.....
Holm & Olson, Inc.	St. Paul	June 27	Peake	.....	.....
Holm & Olson, Inc.	St. Paul	Aug. 12	Wenzel, Conzet, Peake, Nelson	.....	.....
C. Edwin Swenson	St. Peter	Oct. 26	Peake	.....	.....
J. Flagstad & Sons	Sacred Heart	Sept. 27	Peake, Weiss	2,500	1,000
L. Meininger	Sherburn	Oct. 21	Peake	.....	.....
Paul P. Klevann	Starbuck	Sept. 14	Valleau	.....	.....
.....	Stillwater	June 21	Peake	.....	.....
.....	Stillwater	June 26	Peake	.....	.....
Geo. W. Strand	Taylors Falls	May 24	Peake	.....	100
Geo. W. Strand	Taylors Falls	May 30	Conzet, Peake	.....	300
.....	Taylors Falls	June 28, 29 & 30	Peake	.....	.....
.....	Taylors Falls	July 4, 5 & 6	Peake	.....	.....
.....	Taylors Falls	July 6	Washburn	.....	.....
.....	Taylors Falls	July 16 to 24	Peake	.....	.....
.....	Taylors Falls	July 20 to 22	Washburn	.....	.....
.....	Taylors Falls	Sept. 3, 4, 5, 8, 9	Peake	.....	.....
.....	Taylors Falls	Sept. 18	Washburn	.....	.....
.....	Taylors Falls	Sept. 18 and 19	Washburn, Peake	.....	.....
.....	Taylors Falls	Sept. 23 and 24	Peake	.....	.....
Geo. W. Strand	Taylors Falls	Oct. 29	Washburn	.....	.....
J. P. Erickson	Tyler	Sept. 29	Peake, Weiss	1,000	.....
S. J. Wetherall	R.F.D. No. 1, Wayzata	Aug. 9	Washburn	.....	.....
Frank X. Ferodowill	R.F.D. No. 1, Wayzata	June 3	Washburn	.....	30
Frank X. Ferodowill	R.F.D. No. 1, Wayzata	Aug. 8	Washburn	.....	.....
Carl DeLaittre	Wayzata	July 3	Washburn	.....	Few
R. C. Bagley	Wayzata	July 5	Washburn	.....	1
Fred Cowles	West Concord	June 9	Peake	.....	.....
Fred Cowles	West Concord	Sept. 2	Peake, Wenzel	.....	.....
S. D. Richardson	Winnebago	Nov. 1	Peake	.....	.....
Guy Van Duzee	Winnebago	Nov. 1	Peake	.....	.....
C. A. Pfeiffer & Son	Winona	Aug. 26	Washburn	4,000	42
Fruit Breeding Farm	Zumbra Hts.	Sept. 25	Washburn	5,000	.....

The following is a list of the men and the time spent by them in the survey and eradication of White Pine Blister Rust for the season of 1916:

F. L. Washburn	Full time.
G. W. Peake	Full time.
G. M. Conzet	Aug. 16 to 31 inc. Sept. 19 to 30 inc.
O. J. Wenzel	Aug. 6 to Sept. 2 inc.
R. C. Rose	July 16 to 31 inc. Aug. 1 to 11 inc.
D. M. Badger	July 16 to 31 inc. Aug. 1 to 11 inc.
J. P. Jensen	June 27 to Aug. 7 inc.
E. S. Reynolds	June 23 to Aug. 7 inc.
Maynard Coe	June 28 to Oct. 5 inc.
W. D. Valleau	Sept. 10 to 16 inc.
George Nelson	July 25, 27, 28. Aug. 20 to 24 inc. Aug. 1, 9, 16. Sept. 25 to 27 inc.
Freeman Weiss	Aug. 20 to 24 inc. Aug. 27 to 31 inc. Sept. 11 to 15 inc. Sept. 25 to Oct. 1 inc.
S. Marcovitch	Sept. 16 to 19 inc.
John P. Andrews	June 22, 26, 27. July 21.
Edna Seavey (Clerical Help)	June 7, 8, 23, 24. July 18, 19, 20, 21, 22.
Harriet C. Johnson (Clerical Help)	July 5, 6, 10, 12, 13 to 18 inc. July 20, 22, 24, 25. Sept. 16, 23.
Alice M. Bailey	3 days.
Victor Booton	Aug. 1 to 15 inc. Aug. 16 to 26 inc. Aug. 28 to 31 inc. Sept. 1, 2.
Joe Rafter	Aug. 1 to 15 inc. Aug. 16 to 26 inc.

NURSERY INSPECTION IN MINNESOTA.
1916.

The season of 1916 was favorable for the development of diseases and insects in the nurseries, the usually common pests being much more abundant than in most years. The Tussock Moth was especially abundant, and did considerable damage in certain nurseries. One of the red spiders was so plentiful in some nurseries as to make entire blocks of stock look sick, with leaves wilted and brownish. (In some cases the drouth helped to make this condition.) The leaf hoppers, fall web worm, aphids on apples, plums and currants, poplar beetle on poplars and willows, snowy tree cricket on raspberry, blight on poplar, anthracnose on gooseberries and currants, leaf spot on currants, blight on apple, gray bark or spur blight, anthracnose and crowngall on cane fruits were some of the pests reported.

No new infestation of San Jose scale was found this year, and those found the two years previous have been completely stamped out.

The startling part of last season's work was, of course, the finding of white pine blister rust in two of our nurseries. But by heroic methods on the part of the owners of these nurseries we feel justified in saying it has been stamped out within the boundaries of both places.

The coming season we are in hopes the Legislature will give us sufficient funds so we can make a very thorough survey for the blister rust and the San Jose scale in the nurseries and country near each nursery, and in various parks and private plantings throughout the state.

We propose to keep all files in the clerk's room and under her direction. An assistant on full time should be secured for the clerk.

All lists of equipment held by each individual man should be filed with the clerk, and each man should be responsible to the clerk for the proper return of same.

The question of the use of an auto has come up often and in the spring of 1915 Mr. Peake purchased a car privately and charged mileage to pay the running expense. The last two seasons, 1915 and 1916, the inspection work has largely been carried on with the use of this auto in making our circuits and although the cost is somewhat more than railroad fare and auto livery (when only one inspector is concerned), yet the work is so greatly facilitated that it would be a step toward inefficiency to attempt to do the work without an auto. Further, when two or more inspectors are working together it is a saving. It does not seem just, however, that the inspectors should have to invest their own capital in a car on the small salary paid, especially when it has been shown that the mileage does not quite pay current expenses on the car, to say nothing of depreciation in value, interest on the investment, fire and theft risk, tires, etc. That is the reason for asking for a small car, equipped to do the work, to be owned by the state. The car should be light and should be equipped with facilities to carry not only the personal luggage of the inspectors, but also equipment for a field laboratory, such as a dissecting binocular, two spencer hand lens, typewriter, stationery, killing bottles, two breeding cages, etc.

If there are two regular inspectors on this car all of the time it probably can be run for about 7c a mile, which would be fully as cheap as railroad fare and livery hire for two men and from two to three times as efficient in the work of inspecting throughout the state. If this car is obtained we expect to co-operate with the county agents working with each for a day or two when in his territory and in this way being of educational value to the farmer who is growing fruit of any kind.

The following circuits are the most economical as to time and money in the inspection of nurseries if a car is to be used.

CIRCUIT A.

Nurseries in and near Minneapolis and St. Paul, and the Lake Minnetonka region, including the following:

The Baker Nursery, the Board of Park Commissioners of Minneapolis, the Farmer Nursery, the Franklin Nursery, the Minneapolis Nursery, the Rose Hill Nursery, the Hunter Nursery, the Ellison Nursery, Ruedlinger Nursery, the Vine Grove Nursery, all of Minneapolis; Cabinwood Nursery, the Deephaven Nursery, the Ferodowill Nursery, the Hawkinson Nursery, the University Fruit Breeding Farm, the Lake View Nursery and Fruit Farm, the Brackett Nursery, Highlands Fruit Farm, Minnetonka Old Fashioned Flower Garden, the Daniels Nursery, the Minnetonka Nursery, around Lake Minnetonka; the Tong Nursery, Long Lake, Hughart's Sons' Nursery, Hamel, both also in the Lake Minnetonka district; the J. C. B. Anderson Nursery, the Hoyt Nursery, the Bailey Nursery, the Park Nurseries, St. Paul Park and Cemeteries, all of St. Paul.

CIRCUIT B.

St. Paul to Newport and St. Paul Park, Red Wing, Lake City, Plainview, La Crescent, Houston, Preston, Canton, Mabel, Spring Valley, Austin, Waltham, Albert Lea, Owatonna, Mantorville, Byron, Rochester, West Concord, Kenyon, Cannon Falls, return to St. Paul, inspecting the following nurseries en route.

CIRCUIT C.

St. Paul to Farmington, Northfield, Lonsdale, Faribault, Medford, Deerfield, Waterville, Mankato, St. Peter, Winthrop, New Ulm, Garden City, St. James, Sherburn, Fairmont, Winnebago, Adrian, Luverne, Fulda, Jeffers, Lamberton, Tracy, Tyler, Marshall, Cottonwood, Minneota, Canby, Marietta, Madison, Dawson, Watson, Montevideo, Granite Falls, Sacred Heart, Renville, Olivia, Raymond, Willmar, Atwater, Litchfield, Dassel, Cokato, Howard Lake, Delano, Buffalo, Rockford, Hamel, St. Paul.

CIRCUIT D.

St. Paul to Lakeland, Stillwater, Taylors Falls, Lindstrom, Cambridge, Pine City, Hinckley, Onamia, Askov, Kerrick, Nemadji, Cloquet, Duluth, Eveleth, Virginia, Hibbing, Grand Rapids, Grayling, Kimberly, Aitkin, Brainerd, Hubart, Pine River, Little Falls, St. Cloud, Monticello, St. Paul.

CIRCUIT E.

St. Paul to Paynesville, Starbuck, Alexandria, Elbow Lake, Fergus Falls, Battle Lake, Parkers Prairie, Perham, Crookston, East Grand Forks, Warren, Mentor, Bagley, Bemidji, Black Duck, Cass Lake, Itasca Park, Nevis, Hubbard, Eagle Bend, Long Prairie, Grey Eagle, Freeport, Avon, Collegeville, St. Paul.

These routes include most of the towns where nurseries will be inspected. In carrying out the white pine blister rust survey the number of towns and plantings visited will total many times this list.

SUMMARY OF FOREIGN NURSERY STOCK RECEIPTS.

Dec. 1, 1915, to Dec. 1, 1916.

Shipped from	No. of Cases.	No. of Plants.
Holland	372	128,758
Belgium	104	3,831
France	55	385,280
England	6	15,154
Bermuda	1	200
Japan	28	1,573
Scotland	3	16,000
Total	569	550,796

This represents 108 shipments. All plants were inspected by us. While no stock has been received from Germany during the year, it is surprising to note that in this, the third year of the war, there were 32,466 more plants imported than in the second year (1915).

This importation of foreign stock is a menace to our domestic plants and trees, however, because of the diseases and insects, which may find their way into the country in spite of a thorough inspection of the stock, and we believe it would be highly advisable for the United States to discontinue all importations of foreign stock to this country with the exception of such stock as is brought in by the U. S. Dept. of Agr. for experimental purposes.

When we look at the vast amount of damage done in the past, and the property loss at the present time caused by these imported pests, as in the case of the chestnut blight, the citrus canker, the brown tail moth, and the white pine blister rust, we feel that a quarantine against all European stock is advisable.

MINNESOTA NURSERIES INSPECTED AND HOLDING CERTIFICATES GOOD UNTIL NOVEMBER, 1917.

Name of Nursery		Certificate Number		Inspected by
The Albert Lea Nursery O. M. Peterson	Albert Lea	843	Aug. 24	F. L. Washburn
Minnesota State Nursery (Dealer)	Albert Lea	39		
The South Side Nursery Martin Fridholm	Albert Lea	842	Aug. 24	F. L. Washburn
Wedge Nursery Clarence Wedge	Albert Lea	884	Sept. 14	G. W. Peake
Alexandria Fruit Farm and Nursery W. H. Horton	Alexandria	859	Sept. 14	W. D. Valleau
Ferndale Ludvig Mosback	Askov	888	Sept. 11	W. D. Valleau
Atwater Fruit Farm (Dealer)	Atwater	38		
The Austin Nursery C. F. Woodle	Austin	845	Aug. 24	F. L. Washburn
The Turtle Creek Nursery J. M. Lindsay	Austin	844	Aug. 24	F. L. Washburn
A. N. Kinsman, Inc. (Dealers)	Austin	32	Sept. 1	
The Battle Lake Nursery A. A. DeSmidt	Battle Lake	925	Sept. 13	W. D. Valleau
The J. E. Swedberg Nursery (Dealers)	Battle Lake	27	April 6	G. M. Conzet
Laudenback Nursery Tom Laudenback	Bagley	863	Sept. 4	F. L. Washburn

Name of Nursery		Certificate Number		Inspected by
Wah-wah-taysee Lodge T. W. Ingersoll	Buffalo	855	Sept. 13	O. J. Wenzel, G. W. Peake
The Byron Nursery F. E. Cutting	Byron	928	Sept. 1	
Oslund's Nursery N. N. Oslund	Cambridge	909	Sept. 18	G. M. Conzet
Peter Siverts	Canby	929	Sept. 29	Freeman Weiss
Fillmore County Nursery Geo. F. Snyder	Canton	858	Sept. 13	Freeman Weiss
North Star Farm J. W. Beckman	Cokato	922	Sept. 20	F. L. Washburn
Wright County Nursery John Eklof	Cokato	915	Sept. 21	F. L. Washburn
Schuster Nursery Edward W. Schuster	Crookston	908	Sept. 19	G. M. Conzet
Delano Nursery Chas. Sell	Delano	856	Sept. 20	F. L. Washburn
Greysolon Nursery C. E. Roe	Duluth	930	Sept. 12	W. D. Valleau
Taylor's Eagle Bend Nursery T. W. Taylor	Eagle Bend	898	Oct. 13	G. W. Peake
East Grand Forks Nursery Oscar Wick	East Grand Forks	932	Sept. 19	G. M. Conzet
Brackett Nursery A. Brackett	Excelsior	834	Aug. 15	F. L. Washburn
The Deephaven Nursery A. O. Hawkins	Excelsior	849	Sept. 1	F. L. Washburn
The Highlands Fruit Farm C. P. Jackson Land Co.	Excelsior	835	Aug. 15	F. L. Washburn
Chas. Hawkinson Nursery Chas. Hawkinson	Excelsior	850	Sept. 1	F. L. Washburn
Minnetonka Old Fashioned Flower Garden Mrs. N. S. Sawyer	Excelsior	836	Aug. 15	F. L. Washburn
Schmid's Nursery William Schmid	Excelsior	825	April 18	Geo. Nelson
Thurmann's Nursery Co. W. J. C. Thurmann	Excelsior	827	May 5	G. W. Peake
Zumbra Heights Fruit and Poultry Farm August Sauter	Excelsior	871	Sept. 25	F. L. Washburn
Amber Lake Nursery Co. P. C. Christensen	Fairmont	872	Oct. 31	G. W. Peake
Commercial Nurseries of Fairmont (Dealers)	Fairmont	36	Oct. 30	G. W. Peake
Fairmont Nurseries G. D. McKisson	Fairmont	927	Oct. 31	G. W. Peake
The St. John Nursery Co. B. E. St. John	Fairmont	823	Mar. 19	G. W. Peake
The Andrews Nursery John P. Andrews	Faribault	885	Nov. 5	G. W. Peake
Brand Nursery Co.	Faribault	857	Aug. 19	Peake & Wenzel
Farmers' Seed & Nursery Co. Wm. Kueker	Faribault	883	Aug. 16	Peake & Wenzel
Northern Nursery Co. (Dealers)	Faribault	37		
Evergreen Nursery O. A. Th. Solem	Halstad	911	Sept. 21	G. M. Conzet
Hughart's Sons' Nursery Hughart's Sons	Hamel	837	Aug. 18	F. L. Washburn
The Groveland Nursery W. B. Miller	Hopkins, R. F. D.	824	April 13	
Vinegar Hill Nursery Wm. Sandrock	Houston	893	Sept. 12	Freeman Weiss
Howard Lake and Victor Nurseries W. H. Eddy	Howard Lake	873	Sept. 20	F. L. Washburn
Jeffers Trial Station Dewain Cook	Jeffers	931	Sept. 30	Peake & Weiss
The Kenyon Nursery J. A. Mogren & Sons	Kenyon	926	Sept. 1	G. W. Peake
Oak Grove Nursery P. H. Volstad	Kenyon	914	Aug. 31	G. W. Peake
The South Kenyon Nursery E. J. Hershaug	Kenyon	874	Sept. 1	G. W. Peake
Kerrick Fruit Farm Margaret Culle	Kerrick	916	Sept. 21	C. D. Valleau
Ayers Jack Pine Nursery H. B. Ayers	Kimberley	891	June 17	R. C. Rose

Name of Nursery		Certificate Number		Inspected by
The Jewell Nursery Co.	Lake City	829	Aug. 29	G. W. Peake, G. M. Conzet, O. J. Wanzel, Geo. Nelson, Freeman Weiss
The Johnson Nursery P. G. Johnson	Lake City	882	Aug. 22	Conzet & Peake
National Nursery Co. J. L. Anderson	Lake City	851	Aug. 22	G. W. Peake
Sugar Loaf Valley Nursery Co. Moseman Bros.	Lake City	862	Aug. 23	G. M. Conzet
Tolleson Nursery Co. G. A. Tolleson	Lake City	890	Aug. 22	Weiss & Peake
The Mayfield Nurseries L. L. May	Lakeland	900	Sept. 27	Conzet, Peake & Nelson
The Chisago Lake Nursery Ludwig Carlson	Lindstrom	875	June 12	G. W. Peake
The Ferguson Nursery (Dealers) W. C. Ferguson	Litchfield	35		
The Daniels Nursery Franc P. Daniels	Long Lake	831	Aug. 8	F. L. Washburn
The Minnetonka Nursery Douglas Winter	Long Lake	861	May 17	G. W. Peake
The Lonsdale Nursery John P. Vikla	Lonsdale	923	Nov. 2	G. W. Peake
The Madison Nursery M. Soholt	Madison	876	Sept. 28	G. W. Peake
Mankato Nursery L. Z. Smith	Mankato	899	Oct. 27	G. W. Peake
M. M. Sinotte (Dealer)	Mankato	31	July 5	
Dodge County Nursery W. E. Fryer	Mantorville	887	Sept. 2	Peake & Wenzel
Orton Park Nursery C. J. Orton	Marietta	918	Sept. 28	G. W. Peake
Minnesota State Nursery Co. E. C. Eaker	Marshall	886	Sept. 29	Peake & Weiss
The Deerfield Nursery Co. J. F. Brady	Medford	933	Nov. 6	G. W. Peake
The Medford Nursery Grace Patton Eaton	Medford	840	Aug. 22	F. L. Washburn
C. B. Finsaas	Mildred	889	Sept. 27	G. M. Conzet
Harry Franklin Baker	Minneapolis 4629 Harriet Blvd.	904	Oct. 2	G. W. Peake
W. H. Boefferding Co. (Dealers)	Minneapolis 1221 Washington N.	30	May 2	
Cedar Hill Nursery C. N. Ruedlinger	Minneapolis 2929 Colfax S.	905	Nov. 16	F. L. Washburn
The Farmer Nursery E. A. Farmer	Minneapolis Linden Hills Sta.	919	Oct. 6	G. W. Peake
The Minneapolis Park Board Theo. Wirth	Minneapolis 327 City Hall	892	Nov. 15	F. L. Washburn
Northrup, King & Co. (Dealers)	Minneapolis 26 Hennepin Ave.	33	Sept. 6	
Rose Hill Nursery John Hawkins	Minneapolis Eustis & Como S. E.	920	Aug. 16	G. W. Peake Geo. Nelson
Teigland's Nursery J. L. Teigland	Minneota	877	Sept. 29	G. W. Peake
Combercroft Farm & Nursery G. E. MacComber	Nemadji	924	Sept. 12	C. D. Valleau
Nevis Fruit Breeding Station Jas. Arrowood	Nevis	910	Sept. 29	G. M. Conzet
F. J. Hipp	New Brighton, Box 72	848	Aug. 29	G. W. Peake
J. O. Bailey	Newport	921	Sept. 21	F. Weiss
Pioneer Nursery Co. Wm. Pfaender	New Ulm	860	Oct. 1	Peake & Weiss
Northfield Seed & Nursery Co. Jas. M. Punderson	Northfield	839	Aug. 22	F. L. Washburn
North St. Paul Horticultural Farm J. K. Dixon & B. Ballard	North St. Paul	826	April 20	M. Dorsey
Dunsmore Nursery Henry Dunsmore	Olivia	869	Sept. 26	Peake & Weiss
Clinton Falls Nursery Co. Thos. E. Cashman	Owatonna	852	Aug. 25	O. J. Wenzel
Mitchell Nursery Co. D. M. Mitchell	Owatonna	867	Aug. 27	Wenzel & Weiss
The Owatonna Nursery L. J. Wesley	Owatonna	841	Aug. 23	F. L. Washburn
The Elmwood Select Nursery Frank Brown & Son	Paynesville	907	Sept. 15	C. D. Valleau

Name of Nursery		Certificate Number		Inspected by
J. H. Bauer, Nurseryman	Perham	894	Sept. 13	C. D. Valleau
Minnesota Northern Nurseries R. E. Killmer & O. J. Graham.	Pine City	854	Sept. 11	C. D. Valleau
The Preston Nursery C. E. Snyder	Preston	895	Sept. 14	F. Weiss
J. O. Runsten	Princeton	901	Sept. 17	S. Marcovitch
Silver Lake Plant Farm Herman J. Lowell	Princeton, R. F. D. 2	906	Sept. 17	S. Marcovitch
Glendale Fruit Farm G. A. Anderson	Renville	878	Sept. 26	Peake & Weiss
Lake Sarah Specialty Farm F. C. Erkel	Rockford	838	Aug. 18	F. L. Washburn
Sacred Heart Nursery J. Flagstad & Sons	Sacred Heart	868	Sept. 27	Peake & Weiss
The St. Cloud Nursery Co. (Dealers)	St. Cloud	29	May 19	
The St. James Nursery & Greenhouses J. J. Hill	St. James	903	Oct. 27	G. W. Peake
The J. C. B. Andersson Nursery J. C. B. Andersson	St. Paul	853	May 20	G. W. Peake
Emporium Mercantile Co. (Dealers)	St. Paul	28	April 20	
Hoyt Nursery Company C. B. Hoyt	St. Paul Hoyt & Hamline Ave.	917	Aug. 25	Geo. Nelson
Killmer's Northern Nurseries E. C. Killmer	St. Paul 1511 Raymond Ave.	828	May 25	G. W. Peake
The Park Nurseries Holm & Olson, Inc.	St. Paul 20 W. 5th St.	879	Aug. 12	O. J. Wenzel
Nicollet & Sibley County Nurseries C. Edwin Swenson	St. Peter	897	Oct. 26	G. W. Peake
The Meininger Nursery L. Meininger	Sherburn	913	Oct. 31	G. W. Peake
Minnewaska Nursery Paul P. Klevann	Starbuck	870	Sept. 14	C. D. Valleau
Strand's Nursery Geo. W. Strand	Taylors Falls	866	Oct. 29	F. L. Washburn
The Tyler Nursery J. P. Erickson	Tyler	865	Sept. 29	G. W. Peake
E. L. Thomas & Son (Dealers)	Vergas	34		
Maplehurst Nursery Grace E. Kimball	Waltham	864	Sept. 25	Geo. Nelson
Cabinwood Nursery S. J. Wetherall	Wayzata, R. F. D. 1	832	Aug. 9	F. L. Washburn
Ferodowill Nurseries Frank X. Ferodowill	Wayzata, R. F. D. 1	833	Aug. 8	F. L. Washburn
West Concord Nursery Fred Cowles	West Concord	881	Sept. 2	Peake & Wenzel
The S. D. Richardson Nursery S. D. Richardson	Winnebago	880	Nov. 1	G. W. Peake
Winnebago Nursery Guy Van Duzee	Winnebago	912	Nov. 1	G. W. Peake
The Pfeiffer Nursery C. A. Pfeiffer & Son	Winona	847	Aug. 26	F. L. Washburn
The University Fruit-Breeding Farm Nursery State of Minnesota	Zumbra Heights	896	Sept. 25	F. L. Washburn

FINANCIAL STATEMENT.

Dec. 1, 1915, to Dec. 1, 1916.

Balance, Dec. 1, 1915	$1,660.54	
Appropriation, 1916-17	3,000.00	
		$4,660.54
Deputy Inspector's Salary	$1,552.50	
Clerical Service	104.13	
Expert Assistants, Traveling Expenses, etc.	778.63	
Miscellaneous (Apparatus, Office Supplies, etc.)	65.15	
Printing	61.60	
Telephone	15.55	
Traveling Expenses of Deputy Inspector	851.03	
Unused Balance	2.41	
		$3,431.00
Balance, Dec. 1, 1916		$1,229.54

COLLECTIONS—NURSERY FEES.

Cash on hand, December, 1915 (two fees)	$10.00
108 Certificates issued to Nurserymen (1916)	540.00
13 Certificates issued to Dealers (1916)	65.00
	$615.00

Dec. 6, 1916.	Deposited as per State Treasurer's receipt No. 4652	$382.34
	Hennepin County Bank exchange charges	.2.66
Dec. 19, 1916.	Deposited as per State Treasurer's receipt No. 4711	205.00
Feb. 7, 1916.	Deposited as per State Treasurer's receipt No. 4934	25.00
		$615.00

If S. F. 315 and H. F. 601 are not passed by the legislature, giving the state entomologist proper authority to combat White Pine Blister Rust in Minnesota nurseries, and if the Appropriation and Finance Committees do not make adequate appropriation, there will be neither authority nor means to do efficient work in this connection.

F. L. WASHBURN.

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No. 43

OFFICE OF
STATE ENTOMOLOGIST
ST. PAUL, MINN.

CIRCULAR NO. 43
REPRINT OF CIRCULARS 32 & 35
MAY 1, 1917

NOV 27 1918

SOME USEFUL BIRDS FOUND IN MINNESOTA:

THEIR ECONOMIC RELATIONS TO THE AGRICULTURIST

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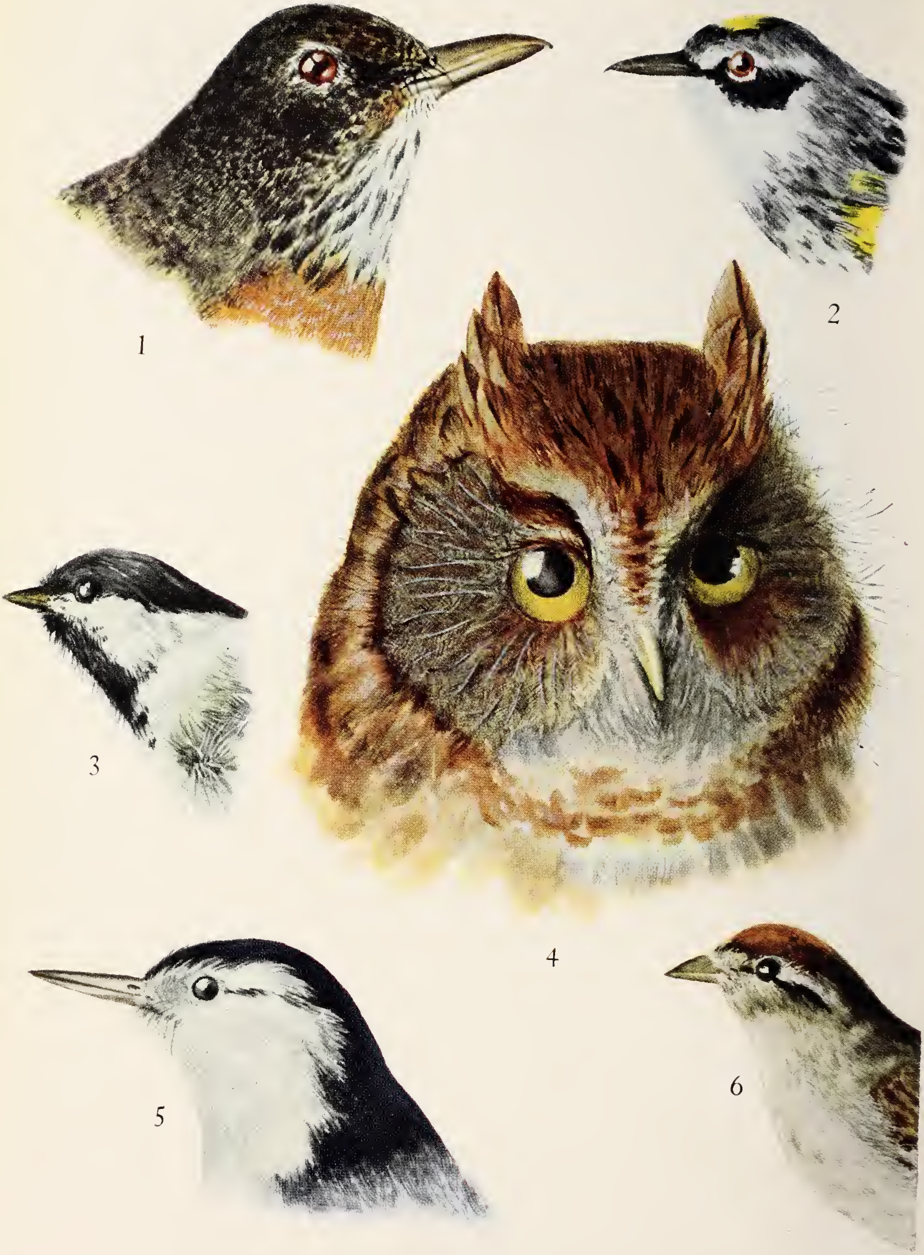

I. L. WOOD, DEL

BUR. ENGRAVING, MPLS.

SOME USEFUL MINNESOTA BIRDS

Plate 1.

SOME USEFUL BIRDS FOUND IN MINNESOTA*

F. L. WASHBURN.

With a total production of approximately $9,000,000,000 worth of agricultural and forestry products in the United States, which products suffer a loss of about $800,000,000 every year through the voraciousness of insect pests, it is not to be wondered at that anything which tends to decrease that loss by which our nation is robbed each year, is of special interest. It is the work of the economic entomologists to restore to the agricultural classes as much as possible of this loss, and, by their researches, to place citizens on their guard against insect enemies. They have been reasonably successful in their efforts, as shown by the large appropriations for this work made by federal and state governments. Massachusetts, for example, has used, in the past, $150,000 annually to combat the gypsy moth, to which must be added approximately $100,000 spent by private citizens in that state and $10,000 contributed by the United States government. New Jersey is on record as spending $350,000 a year in fighting mosquitoes alone. Losses from the San Jose scale, codling moth, Hessian fly, chinch bugs, and grasshoppers have been materially reduced through the work of our entomologists, who have also lessened by nearly or quite half, the $100,000,000 loss on stored products, such as mill stuffs, fruit, cotton, woolens, etc., suffered each year in the United States.

In considering the work of entomologists, however, we must not overlook the value of our birds—many of them wrongly suspected of being without any redeeming quality, in keeping in check the hordes of insects and four-footed vermin that prey upon the crops of farmers, gardeners, and orchardists.

Disregarding any sentimental views upon birds caused by their song and beauty, and basing our opinions as to their usefulness or the contrary purely upon a study of their food-habits at different seasons, and in different years, it is believed that we may safely say that almost all of our common birds, including a goodly number of hawks and owls, the so-called "birds of prey," are useful to the agriculturist and fruit-raiser. Some are more so than others, a few are of doubtful utility, and a still smaller number, representing a very small proportion of our bird fauna, we now regard, in the light of our present knowledge, as injurious. It is possible that additional investigation may cause us to entertain a different opinion of the latter. A farmer, or orchardist, or berry-raiser, or truck gardener, has a perfect right to protect his crops from excessive bird injury and we have seen occasions where possibly resort to a shotgun was justifiable, but, in such cases, one should be absolutely sure that the bird he seeks to destroy is really guilty, that the injury caused is serious, and, particularly, that the benefits accruing from the destruction of a large number of insects on the part of the bird in question, during the nesting season, do not more than compensate for the few berries or small amount of other fruit or of garden or farm crop destroyed. For this information, the agriculturist has to rely mainly upon the results of the studies of experts in this line, since it requires long and careful observations and the examination of a large series of birds' stomachs to place this matter upon even an approximately accurate basis.

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*The demand for State Entomologist's Circulars Nos. 32 and 35 has been so great that the issues are exhausted, and it has been deemed advisable to reprint them in consolidated form. This is intended for popular use in schools to familiarize students with the appearance and habits of some of our more common birds, and is in no way intended as a scientific treatise.—F. L. W.

In this connection, we should note that the parent birds secure the enormous number of insects, which form the main part of the food of the nestlings, as near the nest as possible ; the nearer, the more trips each day and consequently the more insects consumed. A bird nesting a mile away from a berry patch is not going to cover that distance seeking for insects if it can get them near at hand. Therefore, it behooves the agriculturist to encourage nesting of birds upon his own place.

As evidence of the voracity with which birds attack insects, the writer might cite his observations at Lake Minnetonka in September, 1914, at a time when enormous numbers of "gnats" (Chironomids) filled the air, producing, at sunset and after, a humming noise audible for a long distance. These flies are of no special importance to the agriculturist, but by their immense numbers are sometimes disagreeable accompaniments of a sojourn near bodies of water, their larval life being aquatic. In this particular instance, these huge swarms attracted hordes of Tree Swallows massing for their southward migration. These beautiful birds, thousands of them, remained in the vicinity of the lake for several days, and must have made a decided impression upon the numbers of the flies. They not only caught these gnats in the air, but clustered upon trees and even lit upon lawns, seeking the flies in places where the latter had sought shelter from the wind. In an effort to determine how great had been the destruction of gnats by the swallows, the writer secured three of the birds and examined their stomachs. These were found distended with immense quantities of flies, but in such disintegrated condition that anything like an accurate count was impossible. By turning the lens of a camera toward the sky, the accompanying photograph of the swallows was obtained. With hundreds of them on the wing, there were, of course, many out of focus. The indifferent picture, however, may illustrate the fact that the air was literally full of swallows.

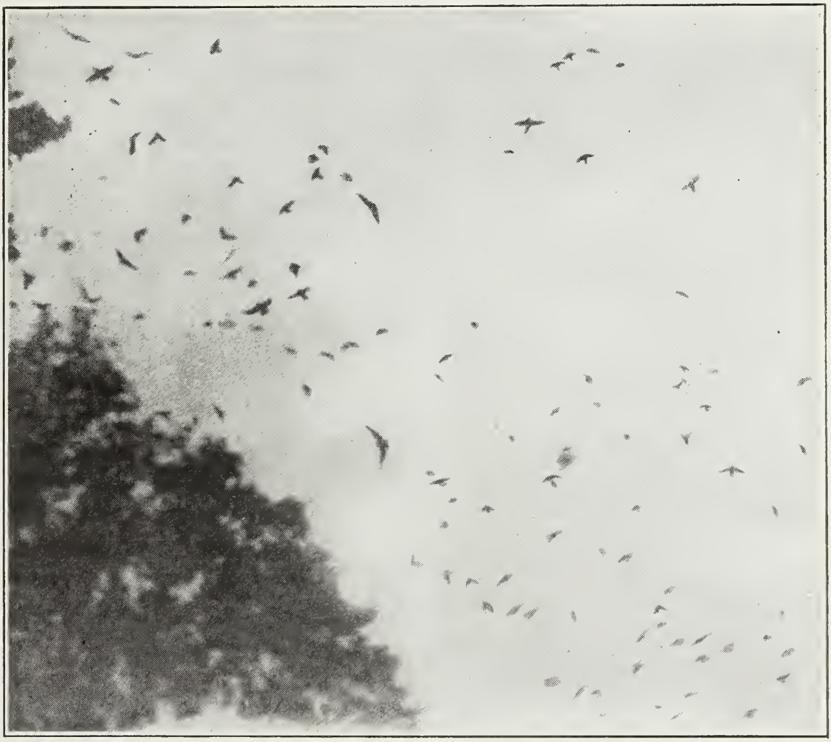


Fig. 5. Tree swallows in enormous numbers catching gnats. Lake Minnetonka, September, 1914.

Reference has been made to the raptorial birds, our hawks and owls. From time immemorial, practically, the farmer's boy has felt justified in shooting every hawk and every owl met with, under the impression that he was doing agriculture a good turn thereby. Whenever he could bring down a crow or shoot into a bunch of blackbirds, he felt an honest conviction that his action would be approved at home; hence he returns triumphant, proudly displaying his dead crow, or hawk, or owl as he walks the village street, while perchance the "partridge" or quail or chicken shot out of season is snugly tucked away in the pocket of his hunting coat.

As a matter of fact, most of our hawks and owls are decidedly useful, preying upon rabbits, squirrels, gophers, field mice, etc.; crows frequently pick up white grubs turned up by the plow, and the writer has seen in Minnesota both blackbirds and crows in the stubble eating large numbers of grasshoppers, in a bad grasshopper year. Of course both of these can be and are at times injurious in corn fields and in grain. And the poultry raiser, particularly if living near timber, will occasionally lose poultry on account of the presence of hawks, but practically never on account of the two or three birds of prey whose heads are shown in the accompanying plates. There are one or two notoriously bad hawks, but the little sparrow hawk, Fig 13, is a great eater of grasshoppers, and the marsh hawk, Fig. 11, so plentiful about meadows and on the prairie, is a constant hunter of field mice and other animals; while the screech owl, Fig. 4, is a useful resident upon any farm as a mouse killer. (See also pages 7 and 8.)

Teachers in our public and district schools have an excellent opportunity to inculcate in the minds of their boys a desire to study the habits of birds and to discourage the maiming and killing of song birds or the destruction of their nests and eggs. Usually the small boy who would "make a collection" of birds' eggs wishes to do so because they attract him partly by their color, partly perhaps by the difficulties involved in securing them, and no doubt also influenced by a desire "to collect" which sometimes makes imperative demands upon both young and old. The loss to agriculture by such collections is decidedly great, a loss which is avoidable if the boy's ambitions can be turned into other channels. Acts of this kind, egg-collecting without a license, and the killing of song birds are, for the most part, punishable by law, but if the child can be led into observance of these laws through an intelligent interest in the birds themselves, the result is better than if fear is the instigating cause. Enough has been said perhaps to emphazie the need upon the part of both adults and young of a careful and discriminating judgment of birds based upon their food habits before condemning them, and the need of encouraging in every way possible their continued presence on farm, in garden, and in orchards by boxes for wrens, bluebirds, and martins, and by exposing material used in nest building; by winter feeding and by fostering generally a wise and humane policy towards our feathered associates. The recent enactment of laws by Congress protecting birds during their migration is one of the best evidences of the growth of a higher, and at the same time, a more practical sentiment in this direction. A brief description of the birds figured on the plates follows.

Except where noted, the male bird is figured and described.

ROBIN.

(Plate I, Fig. 1.)

What would a country home be without robins on the lawn! As a rule, the robin, which is really a thrush, is fairly useful, although a large per cent of its food is fruit, and it eats many useful beetles. Because of our general attachment to the bird, agriculturists will probably try every possible protective means before having recourse to the shotgun when fruit is to be saved.

Individuals of this species are found frequently very late in the fall, and occasionally where evergreen thickets afford shelter, even in the winter. The writer found them in 1885 on November 9th in Otter Tail County. They have been observed in Minnesota, evidently returned from the south, as early as February, but generally they begin to arrive the latter part of March or early in April, welcome harbingers of spring. Two broods are reared. Beetles constitute a large part of the robin's diet during the summer. Beal (Bul. 171, Bur. of Biol. Survey) gives a list of nearly 100 plants, the seeds of which have been found in robins' stomachs. Most prominent among them are blueberries, dogwood, woodbine, sumac, blackberries, cherries (domestic and wild), cedar, mulberries, etc. Since most of these seeds pass thru the alimentary canal with fertility unimpaired, the robin is a disseminator of these plants.

YELLOW-RUMPED WARBLER; MYRTLE WARBLER.

(Plate I, Fig. 2.)

One of our more common warblers, breeding in the northern part of the State and in Canada and observed in vicinity of Minneapolis about April 15th. Found in small flocks amongst bushes and other low growth. Its food consists almost entirely of injurious insects, a small percent only represented by fruit and seeds. It is particularly fond of scale insects and plant lice, and is something of a fly-catcher as well. It is a little over five inches in length, and can be easily recognized by the presence, in the adult males, of a bright yellow patch on rump, on top of head, and on each side of breast. General colors,—grayish with darker stripes, throat white, more or less black on breast and lower parts. In the young and in the adults in late fall, the colors are duller and the characteristic yellow of the crown and rump either very dim or absent. Length, about five and a half inches. Nests in evergreens a few feet above the ground; eggs, whitish-gray blotched with brown or blue.

CHICKADEE.

(Plate I, Fig. 3.)

Found as a resident throughout northern part of the United States and in Canada and Alaska. Dear to us because of its cheerful activity in the cold of winter when almost all other bird friends have left us. From an economic standpoint, a great benefactor, for not only does it consume large numbers of insects in summer, but more than one-half the winter food consists of insects and their eggs. The eggs of plant lice make up one-fifth of the entire food; in fact, the destruction of these eggs on fruit and shade trees is the chief beneficial work of this bird in the winter, and the good it does in this way must not be underestimated. Examinations of the stomachs or crops of these birds have shown that sometimes more than four hundred and fifty eggs of plant lice are consumed by one bird in one day. Eggs of canker worms and tent caterpillars are also eaten. Four stomachs or crops examined showed, as the result of a single day's feed, one thousand and twenty-eight eggs of canker worms. Four others contained about six hundred eggs of canker worms and a hundred and five mature, female canker worms. Surely, if any birds deserves protection, it is this one. Such a familiar bird hardly calls for a description. Head, back of neck and throat, black; sides of head and neck, whitish; breast, white; sides, washed with brownish yellow. Length, about five and one-half inches. Nests in old stumps and decayed trees, preferably birch; holes generally not far from ground. In addition to its cheerful "chick-a-dee-dee" it has a number of other notes, some of them extremely musical.

SCREECH OWL.

(Plate I, Fig. 4.)

Varies greatly in color from reddish or rufous to gray. In rufous specimens, rufous above, generally showing fine black lines. Below, whitish, with feathers barred with reddish or rufous. Or, in grayish specimens, above, brownish gray with faint black markings mingling with brown. Length, about ten inches. This is a quite familiar bird about our orchards and barnyards, and as its food habits show, its presence should be encouraged. Of two hundred and fifty-five stomachs examined under the direction of the United States Department of Agriculture, one contained poultry; thirty-eight contained other birds; ninety-one contained mice; eleven contained other mammals; one hundred contained insects; two contained lizards; four contained batrachians; one contained fish; five contained spiders; nine contained crawfish; seven contained miscellaneous matter; two contained scorpions; two contained earthworms; and forty-three were empty.

THE SNOWY OWL AND GREAT HORNED OWL.

L.A. Fuertes. '97.

Snowy Owl. After Fuertes.

As supplementing a plea in behalf of birds of prey as a class, we introduce here figures and brief notes of two of our owls. The first-named, to be sure, is not a common bird in Minnesota. When seen, it is generally in the winter season, at which time we have occasionally observed it in the bare fields. Our field notes, however, show that this bird was met with occasionally in Otter Tail County in October and November, some years ago. It is, however, distinctly a boreal bird, pushing its migrations southerly only in in its search for food.

The Great Horned Owl, however, arriving here sometimes as early as February, is a common bird within our state borders. Rabbits, gophers, muskrats, field mice, and other night-prowling

Great-horned Owl. After Fuertes.

animals represent a large share of the diet of this owl; poultry, too, if farmers allow their turkeys and chickens to roost in tops of trees, on sheds, or on exposed farm wagons. Even skunks (note the illustration) are highly prized by them for food; in fact, when captured, they are frequently strongly scented with skunk odor. With the exception of the skunk, which is ordinarily a useful citizen, the other mammals mentioned must be regarded as injurious—most of them decidedly so; hence this owl is, to a large degree, a benefactor.

WHITE-BREASTED NUTHATCH.

(Plate I, Fig. 5.)

The only one of our birds which is commonly seen "climbing" down a tree as well as up. About six inches long, gray with white under part; top of head, black; back, bluish. Ranges practically over the entire United States and Mexico. Over one-half of its food consists of insects. Nests in holes in trees. This is one of the few birds which remain with us over winter, at which time we frequently find it associating with chickadees, downy woodpeckers, kinglets, and brown creepers. Its rather coarse note frequently repeated has been likened to the word "yank" repeated, with a nasal sound. A close cousin of this bird, the red-breasted nuthatch, has a somewhat more northerly range. The writer has collected both old and young of the red-breasted nuthatch at St. Vincent in August, and it perhaps finds there its southern limit in this State.

CHIPPING SPARROW; "CHIPPIE."

(Plate I, Fig. 6.)

One of our most common garden birds; unobtrusive, useful and welcome; easily recognized by its modest grayish and brownish colors and the chestnut or bay patch on top of head. Furthermore, it is very friendly; its somewhat monotonous "chipping" note is a common sound in many gardens and dooryards in this country. Eats seed in the fall, at which time its colors change somewhat. During the summer, it helps destroy various insects, including caterpillars, beetles, plant lice, etc. The chipping sparrow is a little over five inches long. Nests in trees or vines near house or in garden or orchard; nest generally lined with horsehair; eggs, four or five, bluish, with blackish or brownish markings. In June it is claimed 93 per cent of its food consists of insects.

YELLOW-BILLED CUCKOO.

(Plate 2, Fig. 7.)

A shy bird with black and long tail a fashionable brown; under parts, white; lower half of bill, yellow, except at tip. Constructs a loose nest of twigs and lays therein, three, four, or five pale-green eggs, unmarked. This bird is generally silent but at times gives utterance to a note repeated in such a way that it sounds like some one calling the cows. Because this is heard sometimes in lowering weather preceding rain, the bird is called by many "rain crow."

Without doubt one of our most useful birds and one of the few which will eat hairy caterpillars such as tent caterpillars and fall web worms. Henshaw (U. S. Dept. Agr., Farmers' Bulletin 513) reports that one stomach which was examined contained two hundred and fifty American tent caterpillars; another two hundred and seventeen fall web worms.

The black-billed Cuckoo is perhaps more common in Minnesota and more generally met with than the above species.

RED-EYED VIREO.

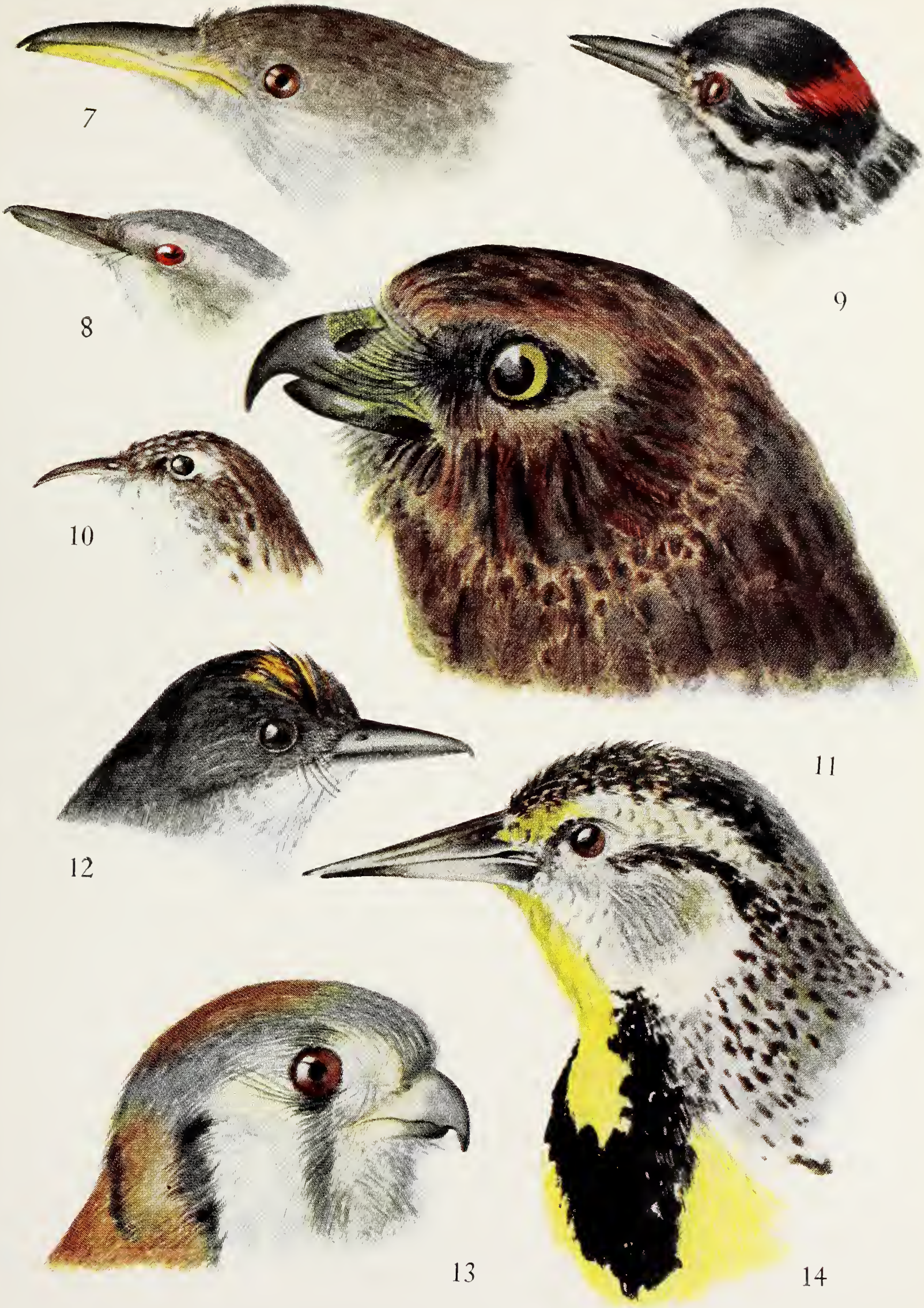
(Plate 2, Fig. 8.)

Who has not heard and enjoyed the song of this bird emanating from shade trees along a village street on a hot day in summer? It is heard at a time when other birds are silent, and if one sees the songster amongst the leaves, he will be found to be actively searching for insects, even while giving voice to his song. The nest is pensile, in a fork, and characteristic in its structure, containing strips of vines, bark of trees, frequently pieces of paper. This nest may be thirty or forty feet above the ground. Eggs, three or four in number, white, the larger end sparingly spotted. The bird is about six and a quarter inches long. Top of head, gray; white line over the eye, which is **red.** The remainder of body olive colored, except under parts, which are white. We found this species to be the most abundant of its family in the Red River Valley some years ago. Over 90 per cent of its food consists of insects.

DOWNY WOODPECKER.

(Plate 2, Fig. 9.)

A true benefactor in that its food consists almost entirely of injurious insects, and it is with us both winter and summer. It is the smallest of our woodpeckers, being only six and four-fifths inches long. Black above; a scarlet band on back of neck; white on middle of back; under part, white; central feathers of tail, black; the outer ones white with black markings; wings, black spotted with white. Length, 6¼ inches. The female lacks the scarlet patch on back of neck. It nests in holes in trees. Often seen in winter in company with nuthatches, chickadees, and brown creepers. What little vegetable food it eats consists of seeds of poison ivy, sumac, etc. Seventeen Wisconsin specimens had eaten forty insect larvae, twenty woodboring grubs, three caterpillars, seven



I. L. WOOD, DEL

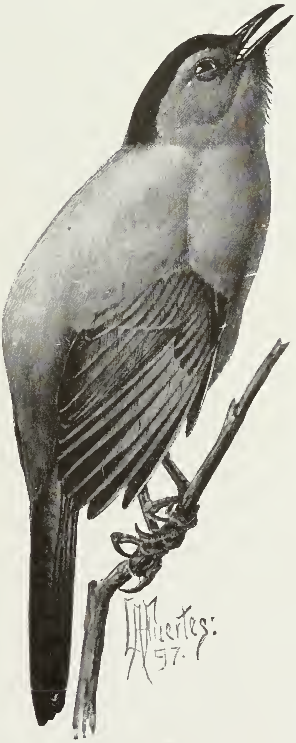
BUR. ENGRAVING, MPLS.

SOME USEFUL MINNESOTA BIRDS

Plate 2.

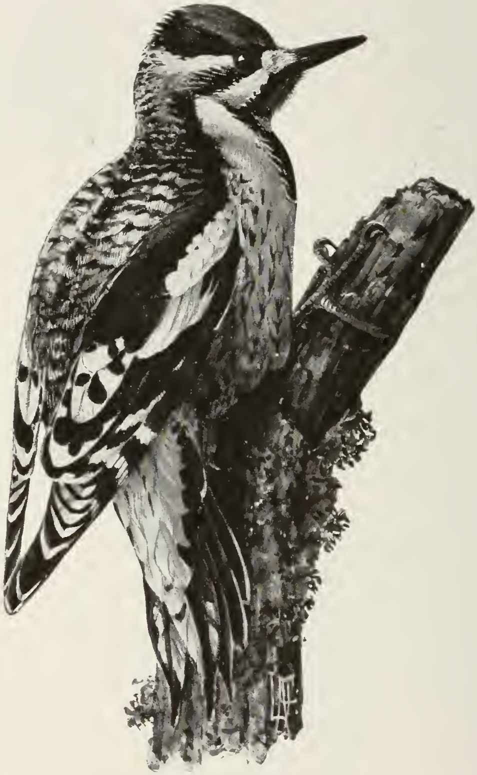
ants, four beetles, a chrysalid, one hundred and ten small bugs, a spider, with a few acorns, small seeds, and a little woody fibre, appearently taken by accident with the grubs. Three-fourths of the food of one hundred and forty specimens examined by the Department of Agriculture consisted of insects. Nearly one-fourth consisted of ants, chiefly those which were caring for plant lice, or burrowing in wood.

THE CAT BIRD.



The writer has been so forcibly reminded of the beautiful song of this bird by the extremely natural appearance of the drawing, that he is led to include it here as a plea for the bird, upon the ground of its qualities as a songster.

THE YELLOW-BELLIED WOODPECKER OR SAPSUCKER



This illustration will prove helpful in enabling one to distinguish between this injurious form and other woodpeckers which are useful. In striking contrast to other birds whose tongues are extensile for extracting borers from infested trees, the tongue of this species has a somewhat "brushlike" tip. It cannot be protruded to any extent, and is thus modified for an entirely different diet from that of other members of the same family. That it seriously injures birches, maples, mountain ash, apple, evergreen, and other trees by girdling them with holes in its seeking for sap and cambium goes without saying. It may and probably does consume a few insects which are attracted to the bleeding holes, but not in sufficient numbers or of the right kind to compensate for the injury inflicted upon the trees. The bird is about 8½ inches long. The adult male has crown and throat red, breast black, and belly a shade of yellow. The female has no red on throat and the red color of the crown is sometimes replaced by black. The downy woodpecker, which is one of our most useful birds, is under 7 inches in length and has a scarlet band on the back of the head in the male—not on the crown. On account of its small size and difference of coloration, it need not be confused with the species under discussion.

BROWN CREEPER.

(Plate 2, Fig. 10.)

This inconspicuous, active bird being with us throughout the entire year is to be ranked amongst our most useful assistants in keeping down injurious insects, for it eats many insects in hibernating stage in winter besides consuming large numbers of insect eggs which would otherwise hatch in the spring. It appears to be always in motion in the daytime, "creeping" over trunks and branches on the lookout for food. General color, brown more or less streaked with lighter colors; white below; about five and one-half inches long; end of tail feathers stiff and pressed against bark of tree after the manner of woodpeckers. Bill slightly curved.

MARSH HAWK (Female).

(Plate 2, Fig. 11.)

Male and female quite different, both in size and color. Adult male nineteen inches long, grayish above, the tail being barred with blackish; feathers above at base of tail (upper tail coverts) conspicuously white; breast, gray, fading into white on belly, where brownish markings are found. The adult female is twenty-two inches long, dark brown above, marked on head and neck with reddish brown; upper tail coverts as in male, conspicuously white; tail darker brown, barred with reddish brown; breast buff, the color fading on belly. Nests on the ground in marshes. This is pre-eminently a bird of the meadows and prairies, and is often seen skimming over the top of the marsh grass hunting its food, at which time the white of the upper tail coverts is conspicuous. It eats field mice, squirrels, rabbits, grasshoppers, frogs, reptiles, and occasionally small birds or poultry, but not often. The writer regards it as a useful bird to the agriculturist. Out of one hundred and twenty-four stomachs examined by the United States Department of Argiculture, seven contained poultry or game birds; thirty-four contained other birds; fifty-seven contained mice; twenty-two contained other mammals; seven contained reptiles; two contained frogs; fourteen contained insects; the contents of one were undetermined, and eight were empty. Dr. B. H. Warren examined fourteen stomachs with the following results: Seven had only held mice in their stomachs; three, frogs; two small birds (warblers); one, a few feather, apparently of a sparrow, and fragments of insects; one, a large number of grasshoppers, with a small quantity of hair, evidently of a young rabbit. This bird is recorded as having been observed in southern Minnesota in January.

KINGBIRD.

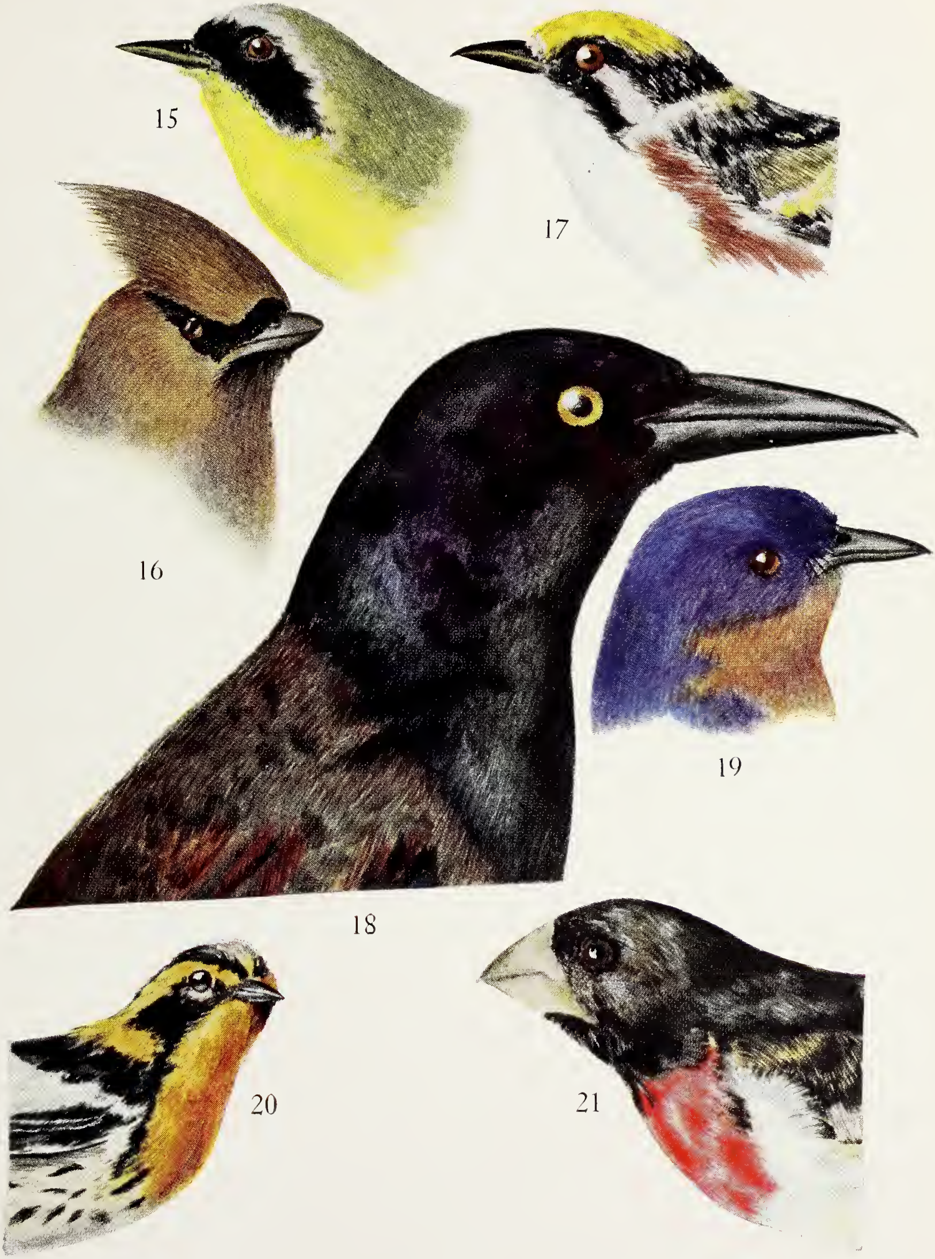
(Plate 2, Fig. 12.)

This is the policeman of our garden and orchard, bravely attacking large hawks and crows which might be disposed to do mischief. It is a typical flycatcher and consumes an enormous number of insects and deserves our protection at all times. What few honey bees he takes appear to be mostly drones; examination of six hundred and thirty-four stomachs showed only 61 bees in 22 stomachs. Of these 51 were useless drones. On the other hand, it devours robber flies which catch and destroy honey bees. (From Biol. Survey Bull. U. S. Dept. of Agr.) Length, eight and a half inches. upper parts, dark gray, almost black on head. Concealed flame-colored crest on head; under parts, whitish.

SPARROW HAWK.

(Plate 2, Fig. 13.)

Our smallest and most beautiful hawk. Common in fields and along roadsides in the late summer and fall, at which time it consumes large numbers of grasshoppers. It also eats other insects, caterpillars, spiders, and at least one-quarter of its food consists of field mice, shrews, and field-dwelling house mice. It occasionally preys upon young birds but this is not a common trait of this species. Quoting from a Biological Survey Bulletin: "Out of four hundred and ten stomachs examined, three hundred and fourteen were found to contain insects, one hundred and twenty-nine small mammals, and seventy, small birds." We unhesitatingly class these amongst our useful birds. It is found throughout the United States, breeding wherever it is a summer resident; is about ten inches long; back, brownish red or rufous with black bars. Black band at end of rufous tail, the extreme end of which is white. Head bluish with brown shadings. Under parts and sides spotted with black. The above brief description applies to the male bird. A hole in a tree is utilized as a nest; eggs, whitish or creamy. three to seven in number.



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SOME USEFUL MINNESOTA BIRDS

Plate 3.

MEADOW LARK.

(Plate 2, Fig. 14.)

The Meadow Lark is common from the Atlantic to the Great Plains, and a variety extends west of the Plains to the Pacific Coast. It is an inhabitant of both prairie land and fields in districts more or less wooded, and while not a fine songster, in the opinion of many, adds much to our enjoyment of the country.

The color of the upper parts is a mingling of black, whitish and chestnut, darker on the head, where we find a light streak running back from the bill; side of head light, showing a yellow streak over and in front of eye; chin, throat, and breast bright yellow, with a jet black collar or cravat on breast in form of a crescent; all but the central tail feathers showing considerable white. Length, ten to eleven inches. It nests upon the ground. Analyses of stomach contents give interesting results: Two hundred and thirty-eight stomachs examined contained seventy-three per cent animal matter, and twenty-seven per cent vegetable, the latter being found in the winter. The animal food consisted of insects of ground species —beetles, bugs, grasshoppers, caterpillars, and a few flies, wasps, and spiders. A number of the stomachs were taken from birds killed when the ground was largely covered with snow, but still contained a large percentage of insects. Crickets and grasshoppers constitute twenty-nine per cent of the entire year's food, and sixty-nine per cent of the food in August. Twenty-one per cent of beetles was found, of which about one-third were predaceous ground beetles; the others all harmful species. In May caterpillars constitute over twenty-eight per cent of the whole food, with a large number of cutworms. Grain makes up fourteen per cent, and weed and other seeds, twelve per cent.

MARYLAND YELLOW THROAT.

(Plate 3, Fig. 15.)

This beautiful warbler is one of the most attractive of the family. It perhaps is not as useful as many others because of its somewhat shy habits and the environment of its nest. It is, nevertheless, thoroughly insectivorous and as such, and because of its beauty, entitled to our friendship. The male has a jet black band across forehead and over the cheeks; remainder of upper parts and tail, olive green; throat and chest, bright yellow. Nest frequently on the ground; eggs, white, speckled. Found throughout the United States east of the Great Plains. We have found it common in the

Red River Valley. It may be regarded as fairly common throughout most of Minnesota, but not conspicuous on account of its retiring habits.

CEDAR BIRD: CEDAR WAXWING, OR "CHERRY BIRD."

(Plate 3, Fig. 16.)

This beautiful bird is about seven inches long, the tips of the secondary feathers in wing and frequently the tail feathers with tips resembling red sealing wax; hence the above name. The head and upper parts, a warm grayish brown; a conspicuous crest; a jet black line across forehead and through eyes; a yellow band across tail at its end; yellowish below.

It is found in varying abundance over the United States and breeds throughout its range. The nest is characteristic, rather bulky but of loose construction, in which rootlets, moss, twigs, and lichens may appear, and is found in fruit trees or shade trees from six feet to fifteen or more above the ground. Eggs have been described as "putty colored." There may be three, four, or five in a clutch and irregularly spotted with black or brownish markings. These birds are fond of canker worms and other caterpillars and are valuable allies in any orchard. One year in August I noted in the Red River Valley a fly-catching habit of this bird and find the following entry in my notes: "For almost half an hour, I watched six of these birds, constantly on the wing, hovering over a slough and catching quantities of (these) insects. They seemed never to grow tired, but flew slowly against the wind, deviating now a little to this side, now to that, until they reached the end of the slough, when back they came to repeat the same maneuver and go over the same ground again and again. Occasionally, they uttered the characteristic note of the species, but, for the most part, flew silently. During the time I stood watching them, they did not once rest." Only nine out of 152 stomachs of this bird (40 of which were taken in cherry season) contained cultivated cherries, and stomachs of other specimens collected have been found filled with canker worms.

CHESTNUT-SIDED WARBLER.

(Plate 3, Fig. 17.)

An attractive insect-eating summer resident, typical of the large family of warblers, a goodly number of which either pass through Minnesota in spring and fall, or nest here. A male bird is figured,—crown, yellow; sides of breast, chestnut; and some greenish yellow in the black of the upper parts; below, white; length, about five inches. It reaches Minnesota about the middle of May.

CROW BLACKBIRD; PURPLE GRACKLE.

(Plate 3, Fig. 18.)

Eats white grubs, grasshoppers, and other insects including army worms but capable of doing damage in grain fields when present there in large flocks. It is at such times that a farmer is justified in protecting his crops by the judicious use of the shotgun. But the bird should not be classified as an enemy to the farmer because it is also known to do good as indicated above. It is unfortunate that the engraver should have placed the bluebird's head, with its contrasting blue, so close to the head of the blackbird. This inharmonious grouping came to the notice of the writer too late for correction. The crow blackbird is twelve inches long, builds a coarse nest of grass and mud, frequently in evergreens, or even in niches in the cornices of public buildings. We have found them as far north as Otter Tail County the latter part of October. In the case of the Red-winged blackbird, in 1083 stomachs examined weed seed comprised 54.6 per cent of the contents, grain 13.19 per cent, grasshoppers (in August) 17 per cent, caterpillers 20 per cent in March, and beetles 10 per cent. In 138 stomachs of the Yellow-headed blackbird insects comprised 33 per cent of the stomach contents, weed seed 28 per cent, grain 38 per cent.

BLUEBIRD.

(Plate 3, Fig. 19.)

Too well known to need detailed description. Found through the United States, Canada, Mexico, and parts of Central America. Upper parts, including wings and tail, bright blue; breast, throat, and sides, reddish. Length, seven inches. It is of wide distribution, from the Atlantic to the Rockies, and from Canada to the Gulf of Mexico. Its note is among the first to be heard in the spring, and one of the last in the fall, at which latter time we associate it with the falling leaves of Indian summer. To the writer, its note in the fall has always appeared to take on additional sadness, as though lamenting the dying of the year. It nests in hollow trees and in boxes erected in suitable places, and should be encouraged by providing it with plenty of such opportunities for housekeeping. An examination of two hundred and five stomachs showed that seventy-six per cent of the food consisted of insects and their allies, while twenty-four per cent is made up of vegetable substances. Beetles constitute twenty-eight per cent of the whole food; grasshoppers, twenty-two; caterpillars, eleven; and various insects, including spiders, comprise the remainder of diet. All these insects are more or less harmful, except a few predaceous beetles, which amount to eight per cent. Prof. S. A. Forbes of Illinois examined one hundred and eight specimens secured in every month except November and January, and results of these examinations prove that although the bluebird eats some insects which are beneficial, and occasionally takes a raspberry or gooseberry, it consumes such an immense number of injurious insects, cutworms, and army worms, moths, grasshoppers, and crickets, that it is undoubtedly a beneficial bird. Nestlings of the bluebird, like the young of almost all of our common birds, are fed an enormous quantity of insects. These birds have been known to arrive in the vicinity of Minneapolis as early as January, but generally they need not be looked for until late in March. They remain with us until late in October and occasionally into November.

BLACKBURNIAN WARBLER.

(Plate 3, Fig. 20.)

A beautiful representative of the warbler family and a strictly insectivorous bird, though breeding as it does in the evergreen woods, it consumes more insects there than it does in the neighborhood of farms. However, even the warblers that pass through this latitude in spring and again in the fall, not nesting here, are useful, in that they are keen hunters of insects found in our trees at that time. The Blackburnian warbler is hardly to be regarded as a common bird in Minnesota and it seems quite natural in view of its gaudy colors that it should winter in the tropics. It is about five and a quarter inches in length, and the male, strikingly colored, is indicated in the illustration. The back is streaked with black and white and the deep orange shown in the figure extends over the chin, throat, and breast; under parts are tinged with the same color. Regarded by many as the most beautiful of all the warblers.

ROSE-BREASTED GROSBEAK.

(Plate 3, Fig. 21.)

This beautiful bird and excellent songster is common in almost all parts of Minnesota, the male at once recognized by the striking black and white coloration and beautiful rose coloring of breast and under side of wings. The female is brownish or olivaceous and in her the rose on the male's wings is replaced by yellow. As the name indicates, the bill is strikingly large and, even without the above colors, would be sufficient to distinguish these birds from other summer bird residents. This species is found breeding as far north as Southern Canada and throughout its range is a help to the agriculturist. It occasionally eats peas and a little fruit, but consumes an enormous number of potato beetles as well as striped cucumber beetles. It is reputed as attacking scale insects and the writer has seen it foraging for grasshoppers. Canker worms, tent caterpillars, army worms, cut worms, chinch bugs, and others are known to be included in its dietary. This grosbeak is about eight inches long; nests from five to fifteen feet or more from the ground; eggs, four or five, light blue with irregular brownish markings. Reaches Minnesota generally about the first week in May, though it has been noted here the latter part of April. In the Red River Valley we have found them common in wooded sections.

The above list is far from complete but it is fairly representative.

We might add the following common and also beneficial birds:

HOUSE WREN.

House Wren, nearly 100 per cent of its food being insects, reaches Minnesota about April 25th.

BARN SWALLOW.

The Barn Swallow captures, while on the wing, moths, flies, beetles, and frequently grasshoppers (house bedbugs, contrary to a very common belief, are not found in swallows' nests).

THE PURPLE MARTIN.

The Purple Martin, an excellent addition to any farm, should be provided with a martin house and its presence encouraged. It wages relentless war upon hawks and crows and constitutes, therefore, a guard for poultry and small birds. In the writer's notes on Minnesota birds occurs the following entry regarding the Purple Martin, resulting from an ornithological trip through the Red River Valley some years ago: "This species, too, occurs about Mille Lacs, where the farmers provide boxes for them. The great majority of them there, however, nest with the gulls on an island called Spirit Island by the Indians, lying about two miles from the southeastern shore of Lake Mille Lacs. Here large numbers lay their eggs in the crevices and fissures of the rocks and serve as allies in driving away the ravens and other birds disposed to prey upon the eggs and young of the gulls." The bird appears to be growing rarer in Minnesota, due perhaps to lack of provision in the way of bird houses. Spirit Island has recently been made a Bird Reserve by the Federal Government.

THE SONG SPARROW.

The Song Sparrow, so dear to us all, deserves a prominent place on our list; it is not only friendly and attractive because of its song and from the fact that it is one of the earliest of bird arrivals from the South, but it consumes a large amount of weed seed and many insects.

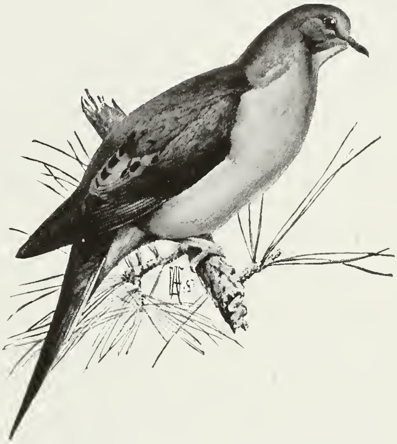
THE YELLOW HAMMER OR FLICKER.

The Yellow Hammer or Flicker, we purposely left off the colored plate, to allow space for a more useful woodpecker. The Flicker or High Hole is something of a "ground bird"; that is, it is very fond of ants and is quite apt to be discovered dining on ants upon the ground. It eats wood-boring grubs to some extent, but is not as industrious in that direction as many of our other woodpeckers. It occasionally takes a little fruit and is reported to eat grain, though rarely. On the whole, it is a useful bird, and we are attached to it because we associate its characteristic call with the promising days of early spring before the leaves appear on the trees.

THE RUBY-CROWNED AND GOLDEN-CROWNED KINGLETS.

The Ruby-crowned and Golden-crowned Kinglets, tiny denizens of woodlands, consume large quantities of beetles, bugs, tree hoppers, scale insects, plant lice and leaf hoppers.

THE MOURNING DOVE.

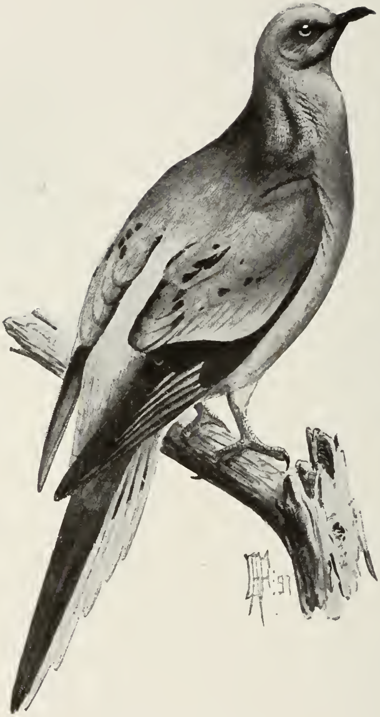


It is unfortunate that the Mourning Dove has been so long included amongst our game birds, as it deserves protection, and we are glad to note that by an act of the Minnesota Legislature at its 1915 session it was placed upon the constantly protected list. A bulletin from the United States Department of Agriculture (Farmers' Bulletin 513, Bureau of Biological Survey) reports the finding in one stomach of seventy-five hundred seeds of yellow wood sorrel; in another sixty-four hundred seeds of foxtail, and in a third twenty-six hundred seeds of slender pospalum, forty-eight hundred and twenty seeds of orange hawkweed, nine hundred fifty of hairy vervain, one hundred twenty of Carolina cranesbill, fifty of yellow wood sorrel, six hundred twenty of panic grass, and forty miscellaneous weed seeds.

The drawing is included here for comparison with that of the Passenger Pigeon or Wild Pigeon with which the species is sometimes confused.

THE WILD PIGEON.

A vanished bird. Several reports from various localities in Minnesota have reached the University of the occurrence of this beautiful bird so common years ago within the confines of the state, but these rumors appear to have arisen either from confusing the Mourning Dove with this species, or to have been fakes, pure and simple. So far, the reward of $1,000 for a pair of these birds nesting has not been claimed. The writer has been, in the past, familiar with the appearance of the Passenger Pigeon at the time when it was extremely abundant in Minnesota and must confess to having been startled a few years ago in traveling by train from Crookston to Bemidji, at catching a momentary glimpse from the car window of two birds in flight amongst the trees, wonderfully resembling in size, color, and shape, the Passenger Pigeon of yesterday. No opportunity was afforded, how-



The Wild Pigeon

ever, to prove this and he dismissed the idea as absurd.* The glory of discovering the existence (if it does exist) of this former summer resident still remains for some aspiring ornithologist.

There is no need of confusing these two birds. The wild pigeon is 16¼ inches long; the ground dove only 11¾ inches, approximately. The upper parts of the former are dove-colored or bluish-slate with metallic reflections on the sides of the neck of the male, while the upper parts of the dove are grayish-brown. The nests of both consist of small twigs loosely put together and containing in each case two white eggs.

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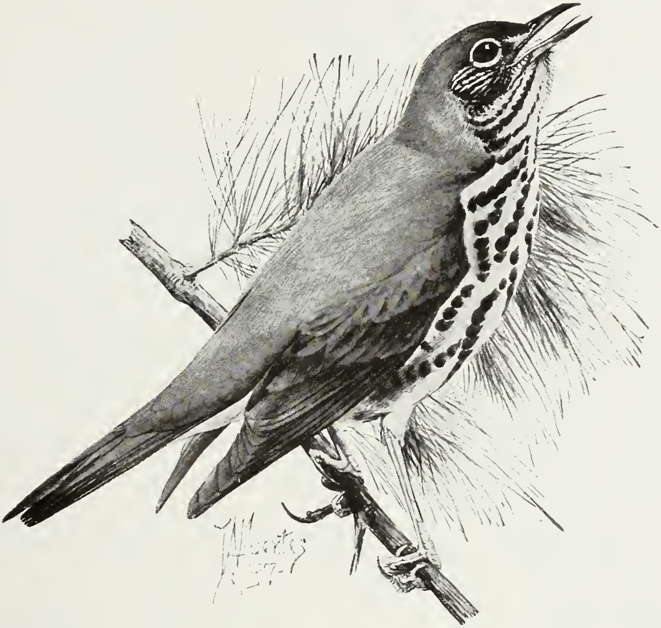
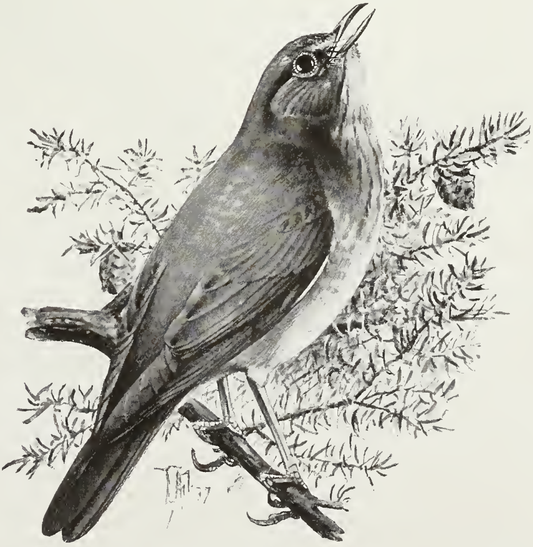
*In this connection it may be noted that Francis L. Palmer of Stillwater, Minn., a student of birds, claims quite emphatically to have observed one of these birds on May 31, 1915, near the above named town, which is in the southeastern part of the state. His observations were published in "Bird Lore" for July-August, 1915, page 289.

THE WOOD THRUSH AND WILSON THRUSH.



The distinct, sharply-outlined, large, round, black spots on the white breast and under parts of the Wood Thrush, together with

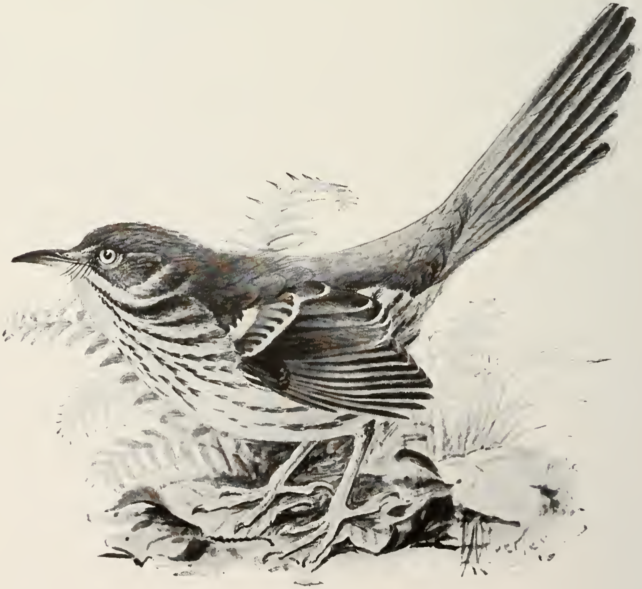


Wilson Thrush.

its larger size, will at once distinguish it from the following species—the Wilson Thrush or Veery, with which it vies in the matter of song. In the latter species, the white breast is more or less tinged with cream and dotted with small, somewhat indistinct brownish, wedge-shaped spots. Its upper parts are brownish but not as bright as in the Wood Thrush.

The first-named bird is 8¼ inches long; the latter (Veery) a little over 7 inches. Both lay greenish-blue eggs in a coarse nest modelled somewhat after the nest of the robin, but the nest of the Veery is on or close to the ground. The beautiful song of both of these birds, coming from the dense woods, if once heard, is never forgotten and they are both important insect-eaters; in fact, the entire thrush family, tho occasional members may be attracted to berries and fruit, notably in the case of the robin, must be credited with being benefactors of the farmer and fruit raiser. Forbes, after a somewhat exhaustive examination of their food habits, states that 61% of the food of thrushes consists of insects.

THE BROWN THRUSH OR BROWN THRASHER.



The excellent illustration here given is sufficient to enable us to recognize this very common bird of our thickets and fields. Rufus brown above, with black spots on a white ground below, its colors and conspicuously long tail make it a notable object when it seeks a prominent position on a lofty branch, preparatory to singing. Its song, while striking, will not compare, we believe, with those of the two preceding nor with that of the cat bird. One of its chief charms, perhaps, lies in the fact that it is an accompaniment of the welcome spring weather. We have been so struck by the little rhyme credited to "Olive" in "Citizen Bird," which certainly is very descriptive of its habits and song, that we venture to repeat it here:

"My creamy breast is speckled
(Perhaps you'd call it freckled)
Black and brown.

"My pliant russet tail
Beats like a frantic flail,
Up and down.

"In the top branch of a tree
You may chance a glance at me,
When I sing.

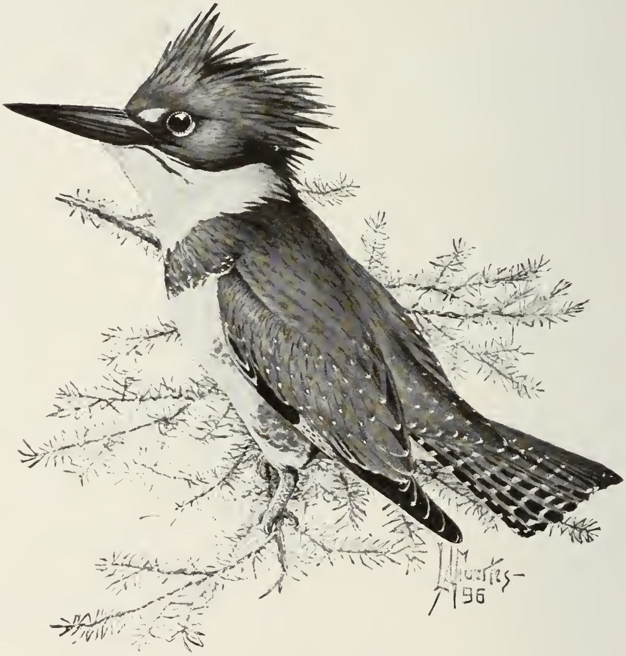
"But I'm very, very shy,
When I silently float by,
On the wing.

"Whew there! Hi there! Such a clatter.
What's the matter—what's the matter?
Really, really?

"Digging, delving, raking, sowing,
Corn is sprouting, corn is growing.
    Plant it, plant it!
    Gather it, gather it!
    Thresh it, thresh it!
    Hide it, hide it, do!
    (I see it—and you.)
Oh! I'm that famous scratcher,
H-a-r-p-o-r-h-y-n-c-h-u-s r-u-f-u-s—Thrasher
Cloaked in brown."

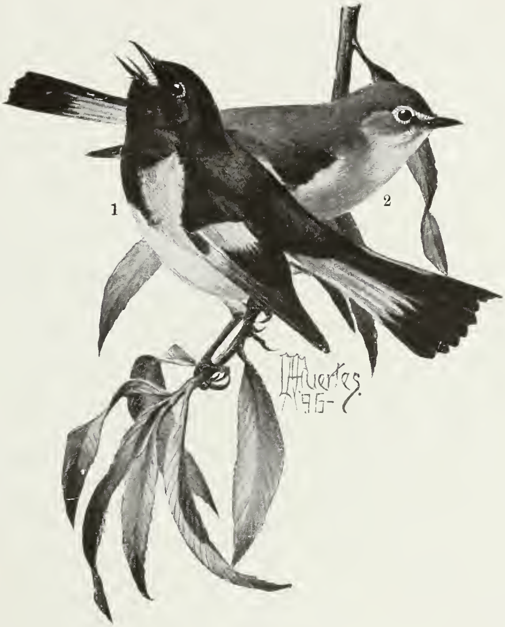
While the brown thrush may take a little fruit or grain, it is a good insect-eater and, as a ground feeder, scratching amongst fallen leaves, it picks up many injurious insects, and it must be admitted, some useful forms as well, the ground beetles, for example.

THE BELTED KINGFISHER.



The above virile picture gives an excellent idea of the appearance of this vivacious, noisy, and, it must be confessed, at times injurious bird. Naturally a lover of wood-bordered streams and ponds, its noisy rattle is a fit accompaniment to the sound of running water and it is here that it takes frequent toll of fish which might otherwise have lived to fill the angler's creel. Fish in ponds and streams, therefore, suffer as a result of its rapacious appetite, but its depredations become of marked importance when it habitually takes its food from ponds or streams of those who raise trout on a commercial scale. Frequently, the shot gun is used by the fish-breeder in self-defense; or taking advantage of the bird's habit of frequenting a perch over the water, whence it can see its prey below the surface, a steel trap is placed on the top of an upright pole planted in the pond and the marauder captured therein. Its white eggs are placed at the end of a long burrow in some bank near the water.

THE AMERICAN REDSTART.

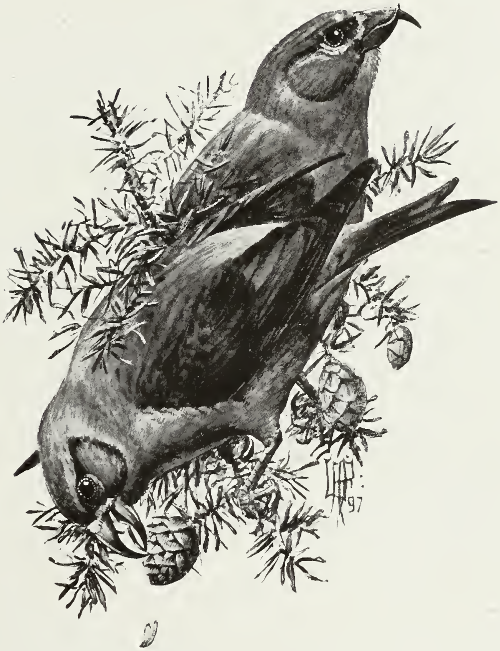


Fuertes' fine drawing illustrates the male (1) and female (2) of this beautiful bird. One of a large group of wood-warblers, examples of which (Blackburnian, Maryland yellow-throat, Chestnut-sided, and Yellow-rumped) are shown in color. The male is striking, not only on account of his brilliant coloring, but also on account of his conspicuousness, since he is extremely active and this activity coupled with the above mentioned brilliancy of coloring, makes him an object to catch the eye of even an indifferent observer. As if conscious of his beauty (breast, head, and back a deep, lustrous black; long wing-feathers at base a rich salmon; about half of the outer tail feathers, sides of breast, and body beneath wings deep salmon) he is continually spreading and flirting his tail, extending his wings, and making short flights from the trees seeking insects, much after the manner of our common fly-catchers. The female is much duller-colored, greenish-gray on head and back and yellowish where the male is salmon.

THE GREAT NORTHERN SHRIKE; BUTCHER BIRD.

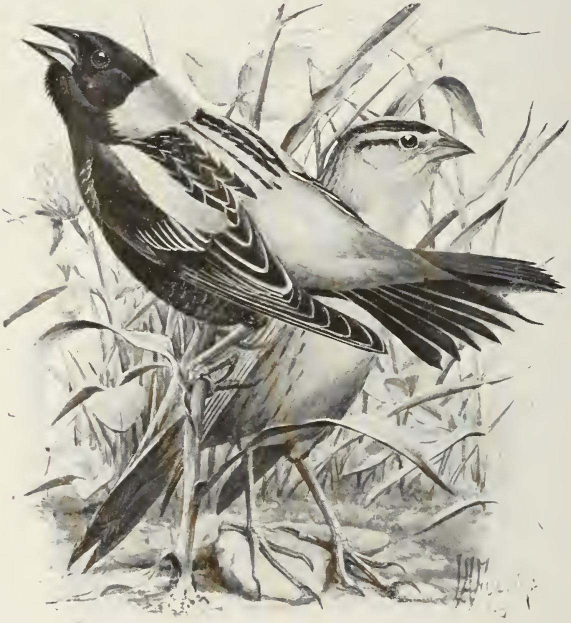
A misconception regarding this bird prevails among many, a mistake which is encouraged by its name and perhaps added to, unfortunately, by the illustrations frequently seen, showing the bird with a captured sparrow. It is true, however, that he kills sparrows and other small birds, a fact evidently fully appreciated by his intended victims, since a panic among them is caused by his appearance, but he atones for this by killing and devouring field mice, shrews, and injurious insects. It is to his credit, also, that he is a persistent enemy of the English sparrow—a bird responsible for many ills and now recognized as one means of dispersal of the much-dreaded San Jose scale. The great northern shrike is common in our fields until late fall, sometimes as late as December in the latitude of Minneapolis, and even later in the southern part of the state, and recognized by his peculiar flight, close to the ground, by his size and coloration. He is about 10¼ inches long, black, gray, and white. At times, he is something of a songster. Amongst injurious insects captured, we might mention grasshoppers and various caterpillars.

AMERICAN CROSSBILL.



A frequent visitor from the North in the fall and during the winter. More common in the timber and wooded country than in open sections, though occasionally seen on some high tree in the middle of a large city. Wherever observed in this latitude, they are always tame and easily approached. The writer has found them in July in the upper Red River Valley, feeding upon the insect contents of poplar galls. These were probably young birds and their occurrence here at that date would indicate the birds breeding at no very great distance.

THE BOBOLINK.



This dandy amongst birds—a favorite of bird lovers and subject of many a song and poem—is a common and welcome summer resident here, filling the fields with drunken melody, while his more modestly-colored mate is sitting quietly on her nest, well hidden in grass or clover. So familiar to all is this songster that with the above excellent illustration before us, no verbal description is necessary.

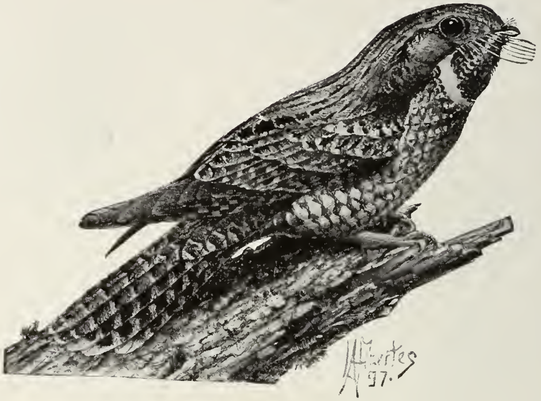
The beauty and song of the male bird are but transient qualities, for after the breeding season, he loses his fine clothes, becomes dull olive-colored, streaked with black, like the female and young, and, in the fall, flocks southward to wild rice marshes and cultivated rice fields, wintering in South America. At night one frequently realizes flocks of these birds are passing, by hearing their metallic "Chink" in the darkened sky above. As "reed bird" and "rice bird," they find their way into the markets of the East and South, fattened by voracious feeding in the rice fields. While with us in the North, they eat large numbers of injurious insects.

THE RED-WINGED BLACKBIRD.

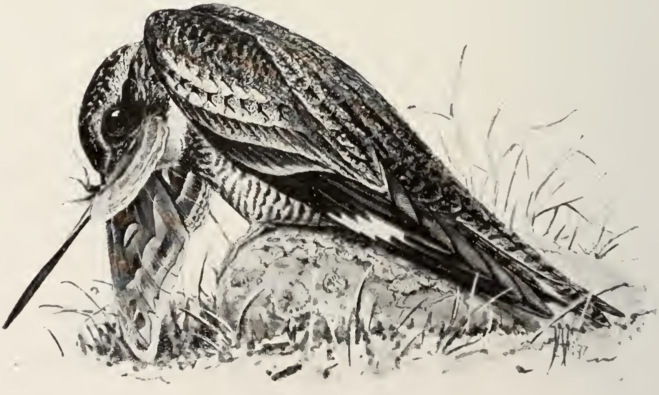
However injurious the group of blackbirds become in late summer and fall, in the spring and early summer they almost or quite pay for their depredations by consuming large numbers of injurious insects. The Red-wing is a welcome arrival in the early spring. Its really melodious note at that time is tuneful comfort to bird lovers, after a long winter devoid of feathered singers. At that time, the position taken by the bird in uttering its characteristic note or notes discloses to advantage its scarlet shoulders well set off by glossy black of wings, body, and tail. The grayish-brown female, streaked with black, we may not notice, but the male compels attention.

The Department of Agriculture has made an exhaustive study of this bird's food habits and finds about ⅞ of its diet consists of harmful insects and weed seeds. Locally when in large flocks, as above intimated, it—with others of its tribe—may be very harmful and a resort, on the part of the farmer, to extreme measures is justified.

THE WHIPPOORWILL AND NIGHT HAWK.


LAFuertes '97.

These two birds, sometimes confused by the uninitiated, yet perfectly distinct species, are both insect-eaters and one of them—the Whippoorwill—not often seen and not very well known. It is a bird of the woods, unless disturbed, flying only by night, and characterized by its peculiar note, oft-repeated: "Whip-poor-will!" "Whip-poor-will!" "Whip-poor-will" with a "cluck" or "chuck" before each call, audible to one close at hand. This song, quite forceful and penetrating, is heard in the first part of the night and just before dawn. In coloration, the bird harmonizes closely with the wood colors. When flushed, it disappears with absolutely noiseless flight.



Night Hawk.

The Night Hawk, on the other hand, is markedly a bird of the open, frequently in flight in the afternoon and early in the evening, high in the air, uttering at frequent intervals his rather harsh cry and occasionally, on half-closed wings, darting down to the earth with a booming sound, made, it is claimed, by the rush of air through his primary wing feathers. The two eggs of the Night Hawk are laid on the ground or in the fields, or even on a flat rock, with no semblance of a nest; occasionally, they are found on flat roofs of buildings in cities. The Whippoorwill's eggs, also two in number, are laid on the ground or on a log or stump in the woods, likewise protected by no nest. The coloring and markings of the two birds also serve to distinguish them. The Whippoorwill's colors partake of the browns, while the Night Hawk is grayish. The tail of the former has the three outer feathers white for about two-thirds their length. Further, the end of the tail is rounding. The latter-named bird has a conspicuous white patch on each wing; its tail is forked. The Whippoorwill feeds largely on moths and beetles; the Night Hawk on May flies, gnats, dragon flies, grasshoppers, etc.

THE QUAIL.

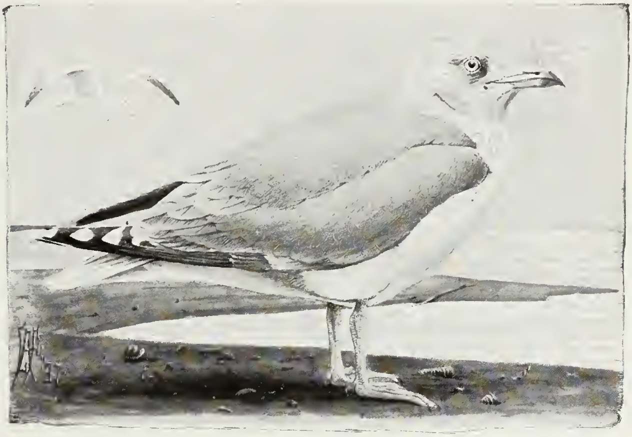
Amongst our game birds, the Quail gets most of its grain after the crop has been gathered; it eats insects, some of them very injurious; large numbers of potato beetles and chinch bugs have been found in its crop; army worms, cut worms and wire worms form a portion of its diet. It appears to be growing more abundant in the State from year to year, and working farther north each season, yet its occurrence in any latitude in any year naturally depends upon the severity of the preceding winter and upon general climatic conditions.

The Virginia Quail or Bob White is holding its own fairly well in Minnesota in spite of our severe winters, pushing its way farther north when conditions are favorable. This bird is such a good friend of the agriculturist that it deserves protection, although its fine qualities as a table bird make it an object of pursuit on the part of hunters. Potato bugs and even chinch bugs have been found in its crop and grasshoppers as well as many other varieties of injurious insects compose a large proportion of its bill of fare.

THE AMERICAN WOODCOCK.

A somewhat rare bird in Minnesota, frequenting the low, wooded, water-courses and generally resorting to the higher lands only during the night. This beautiful game bird is pre-eminently a night-flier and a night-feeder. Its large eyes, placed well toward the top of its head, are not only enabled to gain impressions from above, when the bird's soft beak is buried in the mud, but also are in a position to receive all available light. When flushed, the bird rises softly, directly upward until clear of the brush and then pauses an instant before starting away from the intruder. Their four buff-colored eggs spotted and blotched with brown, are laid on leaves on the ground in an excuse for a nest. This bird has no economic bearing upon agriculture. It is protected in Minnesota until 1918.

THE HERRING GULL AND COMMON TERN.

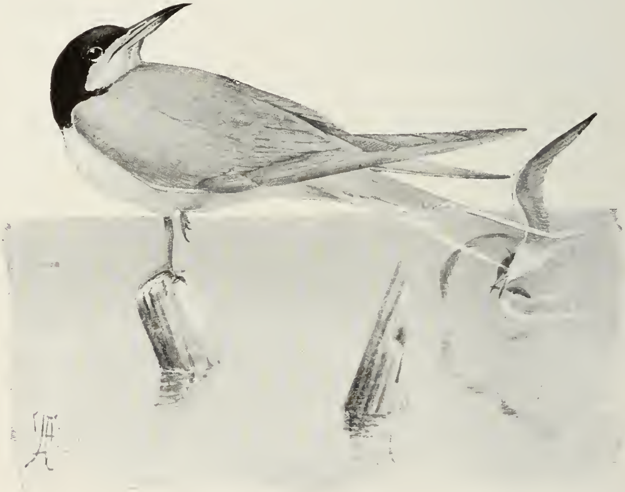


The gull family is a group beneficial to farmers living in a prairie country.

The Black Tern, found so abundantly about our prairie sloughs, and perhaps the most abundant representative of the group in Minnesota, is a good friend of the farmer, for when the sloughs are dry, and even before, they consume large numbers of grasshoppers. Amongst others of this family (gulls), Franklin's Rosy Gull is one of the chief breeders within the State's borders and is a voracious eater of grasshoppers, and, while no illustration of this bird is available, we are pleased to be able to present an excellent drawing of the Common Tern in this publication which will serve to illustrate the group.

The Herring Gull—a good scavenger upon the shore of lake or ocean, typifies the larger members of the family and the species itself, while not as abundant perhaps as other gulls which breed in some of our lakes—is, nevertheless, a Minnesota summer resident, arriving in the southern part of the state early in April, shortly after that working its way north, where some at least nest in our larger lakes, notably Lake Mille Lacs. I have observed them at Devils Lake, Otter Tail County, in October and also find the following observations amongst my notes taken some years ago: "At Lake Mille Lacs, after the wind has been blowing from the East a day or more, these gulls and the two following species, namely, L. *delewarensis* and L. *philadelphia*, are plenty along the west shore, flying up and down the beach and occasionally alighting to pick up small lacustrine mollusks washed ashore with the weed matter. About two miles from the south shore of the lake lie three barren, rocky islands, which are frequented by the gulls in the breeding season. The larger of the three, called Stone Island,—or Spirit Island by the Indians,—containing about three-quarters of an acre and with its top about 20 feet above the surface of the water, affords on its rocky surface a nesting place for hundreds of gulls."

Stomachs of the Herring Gull are found to contain grasshoppers, fish, mollusks, and, in one instance, the remains of a marsh hare, probably consumed as carrion. Professor Aughey reported finding in the stomachs of each of four Black Terns from 47 to 84 grasshoppers or locusts, and in two stomachs examined, from 28 to 59 other insects.

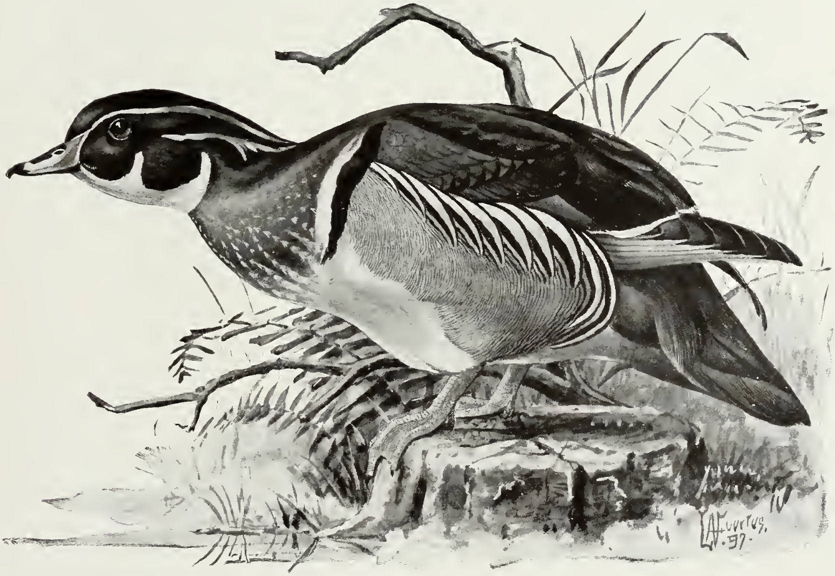


The Common Tern.

THE WOOD DUCK.

A bird like the woodcock and some others, rapidly growing more scarce in Minnesota and included here with the Golden Plover as representing our "vanishing birds." Strikingly tropical-looking is the male bird. In the above excellent illustration imagine the sides of the face and soft crested crown, green with purplish reflections, contrasting sharply with the white of the upper throat, the breast a rich, purplish chestnut, finely spotted with white; sides yellowish, delicately penciled with black, with ends of flank feathers sharply barred with black and white. Back blackish or brownish, with green reflections, and long wing feathers, bluish with green reflections. The eye (iris) bright red. A veritable prince amongst ducks, capable of domestication and worthy of most careful protection. What fisherman, wading a wooded stream, or Nature-lover idling on the bank of a secluded pond, has not been delighted by the flashing colors of these beautiful birds as they leave the water, startled at the approach of an alien, or entranced as they disport themselves in sylvan pool, quite unconscious of the admiring glances they invite!

Dr. P. L. Hatch, in his notes on the birds of Minnesota, 1892, voicing his enthusiasm over this duck, breaks into song as follows: "The most truthful and esthetic description of the mature male could reach no nearer the limning reality than the coldest prose could paint the rainbow. Science, after all her most imposing assumptions, would sit down and weep before the task in black despair. The impotence of all attempts has smirched the skirts of hope by what has been essayed in its systematic, as well as its vernacular nomenclature. Aix sponsa! Shades of Linnaeus, weep cold, clammy tears for thine irremedial dereliction! Wood Duck! Summer Duck!"



The Wood Duck

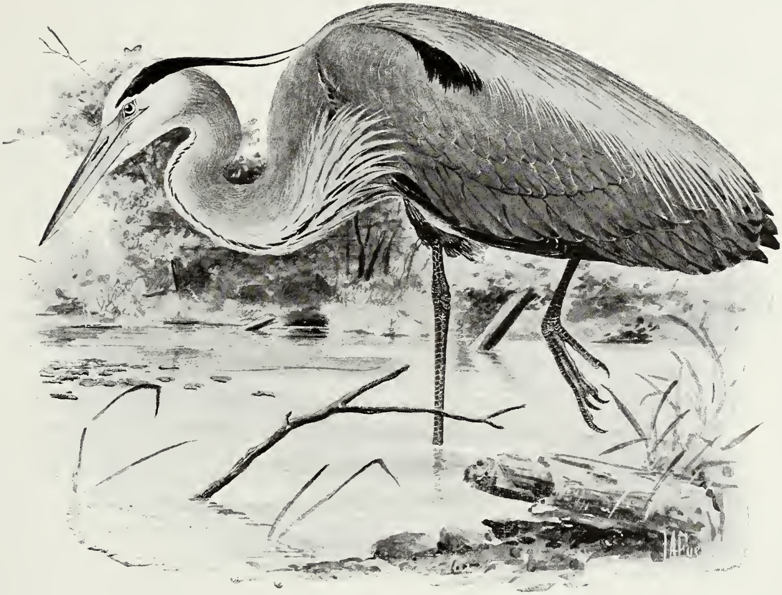
Unlike the majority of ducks, these birds breed in hollow trees overhanging the water. They are typically North American, ranging from Florida to Hudson Bay, but wintering far to the south of our most southern borders. Protected in Minnesota until 1918.

THE GOLDEN PLOVER.

A bird also uncommon, in that it is here irregularly during the migrations, remaining with us only a short time, and now, we believe, rapidly disappearing. The illustration is given here as representing the Killdeer of Ringneck Plover, common in low-lying fields and frequently seen about the barnyard, easily recognized not only by its rather plaintive note but particularly by the black band across the white breast, consumes the larvae of many injurious insects found in pastures and meadows; it eats wire-worms, caterpillars, grasshoppers and crickets and the eggs of the two latter.

While with us, the food of the Golden Plover consists chiefly of grasshoppers and other insects. Together with the Upland Plover or Field Plover, another vanishing bird, it is protected in Minnesota until 1918.

THE BLUE HERON.



Another of our wading birds, wrongly referred to frequently as "Crane." The cranes, be it said, are rather birds of the plains and prairies—not of wooded sections, where we find these fishermen abundantly represented. Its food consists of frogs and fish, but grasshoppers and field mice are not scorned. Like the kingfisher, it may become destructive when frequenting the ponds of the fish-breeder.

BAD BIRDS.

Under this head, we would unhesitatingly place the Sharkshinned Hawk, Cooper's Hawk and Goshawk, the chief marauders against poultry and small birds; the Yellow-bellied Wood-pecker, or "Sap-sucker," which feeds upon the sap of trees, leaving rows of holes about the trunk, and the English Sparrow, or more correctly speaking, the European House Sparrow.

The Sap-sucker (the only bad woodpecker we have) preys upon birch, maple, apples, mountain ash, evergreens, and other trees. Some of the cambium or inner layer of bark is eaten also. While this bird eats a few insects, the damage it does in causing trees to bleed, far outweighs the benefits derived from its presence.

THE ENGLISH SPARROW PEST.

It is now claimed by some scientists, perhaps with reason, that the English or European sparrow is, in part, responsible for the spread of the foot-and-mouth disease. Naturally, the dislike for the sparrow increases at this report. Farmers are urged to do all they can to eliminate this pest as far as possible. We have experienced some success in the use of a sparrow trap, catching from 11 to 25 in a half day. It must be noted, however, that this does not occur every day and, further, that the young birds are most easily caught. Both old and young evidently learn to avoid the trap. Another party who has used this trap also reports success even greater than ours. Other parties report an average catch of ten bids a day for nearly four months. One can also, if on a farm, resort to shooting them singly or, better, when gathered together feeding. In fact, they may be baited with grain for a few days (preferably in the fall or winter) and previous to the use of the shotgun. This accustoms them to gathering in a close flock. Eggs and nests may be repeatedly destroyed, if placed within reach. A well-directed stream of water from a hose is helpful in making them desert their roosts, at least for a while.

Dearborn (Farmers' Bulletin No. 493, U. S. Dept. Agr.) describes nest-box traps. Sparrows may also be poisoned, but this calls for extreme care.

It eats some insects, but its noisy chatter, filthy habits, and pugnacious disposition make it un undesirable bird for any community, and it is probably the most abundant bird over the United States, in country as well as in city.

BIRDS OF DOUBTFUL UTILITY.

Amongst doubtful birds, we place with reluctance our friend the Cat-bird. Although having a delightful song, equal or surpassing that of the Brown Thrush in our estimation, it nevertheless is not of valuable assistance to the gardener or farmer. It eats some insects, it is true, but in the latter part of June "these insects were largely replaced by cherries, currants, raspberries, and strawberries. Three-fourths of the food of eleven July Cat-birds consisted of small fruits, mostly (64%) blackberries. Nine per cent of beetles had been taken, most of them being predaceous (beneficial)." (From observations by Forbes of Illinois in "Birds in Their Relation to Man," by Weed & Dearborn.) Nevertheless, on account of its song and friendliness and from the fact that it does consume injurious insects, the Cat-bird will doubtless continue to be protected except in cases of particularly flagrant destructiveness.

THE CROW AND THE BLUEJAY.

The Crow and the various blackbirds will at times call for radical treatment. The writer has seen both crows and blackbirds hunting grasshoppers in stubble fields and both are known to eat other insects, yet their food habits are such as to make their constant protection undesirable and, when necessary, the farmer should not hestitate to resort to extreme measures to protect his crop. Crows, it should be noted, eat field mice.

Like the Crow, our Bluejay sometimes robs birds' nests of both eggs and young birds. However, since he is something of an insect eater, and only occasionally resorts to corn or other grain, it would be hardly just to make war upon him.

Interesting and valuable publications upon the subject of birds are Chapman's "Bird Life" (not economic), Appletons publishers; "Birds in Their Relation to Man," by Weed and Dearborn, Lippincott; Chapman's "Handbook of Birds of Eastern North America;" synoptical and descriptive; very helpful in identification, Appleton & Co.

Amongst larger works, perhaps not so easily accessible to the amateur, are Coues' "Key to North American Birds"; Baird, Brewer & Ridgway's "North American Birds"; several publications of the Department of Agriculture, for the most part out of print now, and somewhat antiquated; and more recently Farmers' Bulletin No. 531 (U. S. Bureau of Biological Survey) "Fifty Common Birds" with colored illustrations (out of print); and a helpful publication upon "Bird Houses and How to Build Them," by Dearborn—Farmers' Bulletin No. 609, Sept. 11, 1914.

In the United States Yearbook for 1909, pp. 185-196 (Yearbook Separate No. 504) occurs an interesting article by McAtee on "Plants Useful to Attract Birds and Protect Fruit."

We may also list here the following publications from the U. S. Department of Agriculture:

Farmers' Bulletins 497, 506, 630, dealing with the economic value of a large number of common birds. Bulletin 621 of the Bureau of Biological Survey, entitled "How to Attract Birds in Northeastern United States;" also from the same Bureau, Bulletin 185, on bird migration, and Bulletins 205 and 217, dealing with ducks and other water fowl.

HOW TO STUDY BIRDS.

For one disposed to make a study of birds, a few reliable and helpful books, referred to elsewhere in this pamphlet, a pair of field glasses (inexpensive ones if necessary), a camera, if one should have the time and inclination towards that phase of the work, and a love of field and wood to invite to the haunts of birds is all that is necessary. Observation sheets may be obtained from the Bureau of Biological Survey at Washington, and this Bureau is always glad to receive notes on bird migration and kindred phenomena.

The writer, as a result of several years' observation, constructed a table for reference, something as follows:—Twelve spaces, separated from each other by heavy lines were made on card or cards of suitable size for the pocket. These spaces represented the months. An additional wider space was left on the left for birds' names. Opposite the name of each bird studied was entered a mark denoting whether the bird was common, fairly common, rare, or a summer resident, a permanent resident, or an occasional visitor. A line was drawn through the month spaces so as to show date of its appearance and departure. For instance, opposite the name of robin, appeared a long heavy dash running from the latter part of the space devoted to March, through the space devoted to the intervening months, and into November far enough to indicate approximately the date of departure of the robins. A bird which was a summer resident, though rare, would have a lineal mark of some sort, possibly a broken line, differing from the line indicating a common resident put against the robin's name. This line would also pass through the summer months, and so on.

This of course is somewhat crude but will serve as a suggestion to students of bird life. These cards (and two would suffice if one made use of fine writing) were inclosed in a leather covered case and carried in the pocket, forming a ready reference for use in the woods. On starting into the field one could tell at a glance what birds might be met with. New and unrecorded observations would occasionally call for changes on cards, and these could be easily made.

How to Attract the Birds: Allowing that birds deserve our protection, one naturally asks, what can we do to draw them about us. Trees and shrubbery of course attract them, and McAtee (Farmers' Bulletin 621, Bureau Biological Survey) gives a list of about 80 trees or shrubs—a portion of which grow in Minnesota—

whose fruit affords food to the birds. Some of these should be on everyone's grounds.

The establishment of bird refuges and game preserves are doing much to conserve bird life. The artistic bird houses now on the market not only constructed for blue birds, wrens, and martins, but also for nuthatches, woodpeckers, and other species, are a help in this direction. An ingenious boy or man can easily construct houses which answer the requirements very well and at but little expense.

In passing, it may be well to state a few very necessary facts about bird houses known to many but not all. Wren houses should be freed of the preceding year's litter before one can expect them to attract new comers. If the entrance to a wren house is the size of a silver quarter, it will admit the wren but keep out the European or English sparrow. Martin houses should be placed on high poles or in conspicuous places where the martins can see them, not too near to trees. A weather-worn martin house, by the way, is apparently more attractive to these birds than a newly painted domicile.

The Brush Hill Bird Club, of Milton, Mass., has published the following directions relative to the construction of bird houses:

BLUEBIRDS AND TREE SWALLOW:—Box, 12x6x5; size of hole, 1½ inches; height from ground, 8 to 30 feet.

WRENS AND CHICKADEES:—Box, 12x5x4 inches; size of hole, 1¼ inches; height, 6 to 25 feet.

FLICKERS:—Box, 15x10x8 inches; hole, 3 to 3½ inches; height, 6 to 25 feet.

SCREECH OWL:—Box, 15x12x12 inches; hole, 3 to 3½ inches; height, 15 feet.

MARTIN HOUSE COLONY:—Holes, 2 inches; pole, 16 to 20 feet high in open spot where Martins can easily see it.

The cover should be detachable so that the box can be cleaned easily.

A sloping top with an overhang is a protection to the young birds from both sun and rain.

Squirrels may be kept out of the boxes by putting a piece of zinc around the hole so that they cannot enlarge it by gnawing.

The box should be ventilated.

Poles are preferable to trees for erecting houses, as they afford protection from both cats and squirrels.

Wood is the best material. Tin or earthen boxes should be placed in the shade.

The entrances to bird houses should be, as far as possible, on the sheltered side, protected, to a certain extent, from rain, and it should be borne in mind that too much "meddling" on the part of human bipeds is not relished by birds and that the fewer cats, the more birds. It is claimed that one house cat will kill at least 50 birds in a summer in a locality well populated with birds. Shallow receptacles filled with water are very attractive to the birds which appear to be very fond of bathing in warm weather. These can either be made at home or can be purchased of dealers.

Feeding Birds: In summer, birds generally obtain enough food without special help from man, but in winter, when the natural food is scarce or covered with snow, any provision in this direction which we may offer is appreciated. Shrubs, some of which have fruit on their branches all winter, have been referred to above. In addition, one may give them suet, or meat, or grain, and receptacles may be constructed or purchased to hold these somewhat differing foods and protect them from the weather. We have, personally, tacked lumps of suet to tree trunks with nails and have been gratified, in snowy weather, at seeing numbers of chickadees, nuthatches, brown creepers, downy woodpeckers, and blue jays, avail themselves of food thus offered. There is a better way of feeding suet by enclosing it in wire and thus avoiding any waste.

HOW TO PROTECT CROPS FROM BIRDS.

Since man, in clearing and cultivating the land, has removed much of the natural vegetable food of birds, and has frequently replaced it with equally appetizing domestic fruit and vegetables, it is very natural that the birds turn to the cultivated fruit apparently placed within reach for their special benefit. The protection of crops from the attack of birds therefore, becomes at times a serious problem to the gardener or orchardist or farmer, who appreciating the services rendered earlier in the season, is loth to kill the innocent marauders, or even if so disposed, is restrained by law.

Protection of Garden Truck: It tries even a bird lover's patience to see garden peas over which he has spent time and labor disappear before his eyes as fast as the pods fill. In our own experience (summer of 1915) Orioles were the chief malefactors in this connection though later the Rose-breasted Grosbeak developed a fondness for this vegetable. A scarecrow erected near the rows did little or no good, but cheap white mosquito bar over the plant, proved effective, albeit a little expensive and possibly having no particularly good effect upon the growth and development of the pods. This netting can be pegged down on either side of the rows so as to completely exclude the birds.

In our own garden this was not done on every row, but it was found that orioles once caught under the netting become so terrified that when finally released did not again trouble the plants. A friend has suggested the following, much in use in South Africa, where some protection against birds is absolutely necessary: Two stakes are driven into the ground at each end of the row, i. e., a stake at each "corner," then ordinary cheap black cotton thread is run from stake to stake as high as or higher than the plant, and close enough together to make it impossible for the birds to fly onto the peas without striking one or more strands. Apparently this thread is not seen by them and contact with it inspires the same terror as when caught under the netting above referred to.

Netting is frequently resorted to in protecting strawberries, currants, cherries and other fruit. Some birds are intimidated by white strings or rags, (but not the orioles with a fondness for peas above referred to) or bright pieces of tin swaying in the breeze. Other means of saving products of the garden will no doubt suggest themselves to the gardener.

Protection of Field Crops from Birds and Other Animals: Corn, after being planted, is subject to the attacks of a few animals which cause loss to the farmer. Chief among these at times is the crow, and any treatment given the seed to protect it from the attacks of this bird, will, at the same time, afford protection against a few insects which occasionally eat the seed, and also reduce the loss from striped squirrels, gophers, and kindred four-footed creatures.

We have found that white twine about the edges of a corn field, strung on high poles, and hung with strips of tin (one about every thirty feet), white rags, etc., to be fairly effective in keeping crows away from a planted field. If, in addition to this, a few dead crows are suspended from high poles in different parts of the field, the combination of white twine, bright tin shining in the sun, and the dead crows as a warning to would-be evil doers, works so well that the farmer may rest assured it will be many days before his field is touched by these marauders. This remedy, or the twine alone, by the way, is in quite general use today.

Crows can be poisoned by dissolving ten cents worth of sulphate of strychnine in enough hot water to soak up two quarts of corn. This should be scattered about the field where crows are working late in the evening that they may find it there in the early morning.

If scarecrows are used they should be changed occasionally. Forbush in "Useful Birds and Their Protection," advises the use of a barrel hung on a leaning pole.

One of the safest and best ways of tarring corn and yet not affecting its use in a planter is one originating in Massachusetts. "Put one-fourth to one-half bushel of corn in a half-barrel tub; pour in a pailful of hot water, or as much as is necessary to well cover the corn; dip a stick in gas tar and stir this briskly in the corn; repeat until the corn is entirely black; pour off on to burlap (bran sacks are good); spread in the sun and stir two or three times during the day. If this work is done in the morning and the day is sunny, the corn will be ready for the planter the next day without any other care." A machine will easily handle corn treated in this way. Another way is as follows: "Put corn in fertilizer sack, pour (thinned) tar on corn, tie the sack; let the boys tumble the sack about; add ashes or land plaster; tie sack, tumble some more and it is ready for the planter." The gas tar can be and should be diluted with linseed oil.

If one is a good enough shot with a rifle, and can pick off a crow or two at long range, the birds keep away from a field so protected. Even if not hit they seem to realize that it is dangerous ground. Any birds killed should be hung up in the field.

ACKNOWLEDGMENT.

We are particularly fortunate, through the kindness of the artist, Louis Agassiz Fuertes, of Mabel Osgood Wright, the living author, and the Macmillan Company, publishers of "Citizen Bird," to be able to present here a few of the excellent and accurate illustrations with which that publication is adorned. It is with the greatest pleasure that we acknowledge our appreciation of the courtesy extended by the above. All of the illustrations in black and white (except the photo of tree swallows on page 3) are the work of Mr. Fuertes.

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No. 44

OFFICE OF
STATE ENTOMOLOGIST
UNIVERSITY FARM
ST. PAUL, - MINN.

CIRCULAR NO. 44
OCT. 15, 1917

NOV 27 1918

HOUSEHOLD INSECTS

Cockroaches or "Croton Bugs," Moths, Buffalo Moth or Carpet Beetle, Remedies for Bed Bugs, Fleas, Silver Fish, Ants in the House and Garden, Bean Weevils

By

F. L. Washburn, State Entomologist

and

C. W. Howard, Head of Section of Parasitology.

~~Illinois State Natural History Survey~~
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STATE OF MINNESOTA—ENTOMOLOGIST'S OFFICE
Agricultural Experiment Station.

LETTER OF TRANSMITTAL.

St. Paul, October 15, 1917.

HIS EXCELLENCY,
J. A. A. BURNQUIST,
St. Paul, Minnesota.

Dear Sir: I herewith hand you for your approval Copy for Circular No. 44, representing a reprint of various publications covering the subject of Household Insects. The issues of previous circulars on this subject have been entirely exhausted, and since there is much demand for information upon these points a reprint seems necessary. Therefore, I respectfully recommend the printing of the accompanying manuscript as Circular No. 44, "Household Insects."

F. L. WASHBURN, State Entomologist.

Approved:
J. A. A. BURNQUIST, Governor.

COCKROACHES OR "CROTON BUGS."

Ectobia (Phylloderma) germanica.

This pest is distributed practically over the entire globe. While it is not as obnoxious as the previous two insects in that it does not, like those, attack man personally, yet its presence in or about food is sufficient to elicit expressions of disgust from any but the most callous. The species under discussion is only one of several, but is the only one to be considered here in that it is the species which is most annoying to housekeepers of this section.

It is brownish in color, with two darker stripes on thorax, the adults furnished with thin wing covers under which are a pair of true wings. In the younger stages it is wingless. The adults are rapid runners, and both old and young are lovers of darkness, and quickly hide in cracks and crevices at the approach of light. The opening of a drawer or a cupboard in the daytime will often send them scurrying away to more secure retreats. The female, which like the adult male, is a little over half an inch long, may frequently be seen dragging about behind her the oblong egg case, quite as long as she is. This case is packed full of eggs, and in a short time the eggs hatch, each egg case or capsule giving rise to a large number of young roaches.

It is claimed that this particular cockroach requires from four and a half to six months to reach maturity. It feeds upon all kinds of starchy food, is frequently a great pest in bakeries, and at times startles the patron of some restaurant by scuttling across the table under his very eyes. It is therefore, one of the most obnoxious and disgusting of pests, even though it does man no direct harm.

Remedies and Methods of Prevention.—The cockroach has evidently, like the bedbug, learned discretion in its attitude toward man, and is extremely wary and on its guard against all poison baits. Once thoroughly established in a dwelling it is extremely difficult to eradicate. Particularly is this the case when it has taken possession of a flat or hotel, where, by running along the water pipes, it can avoid danger, traveling from room to room or from house to house.

This Division has tried various traps, and practically all the proprietary remedies, besides certain poison baits of our own invention, only to find that almost any remedy is useless as soon as this insect realizes, as it appears to, that it (the remedy) is aimed toward its extermination.

Perhaps the most important advice to offer in connection with this insect is that the housekeeper should **at the very first appearance of the pest, begin a war of extermination immediately.** Every day of delay means a probable increase in the ranks of the enemy, and, as stated above, when once well established, it is a Herculean task to eradicate them. A careful

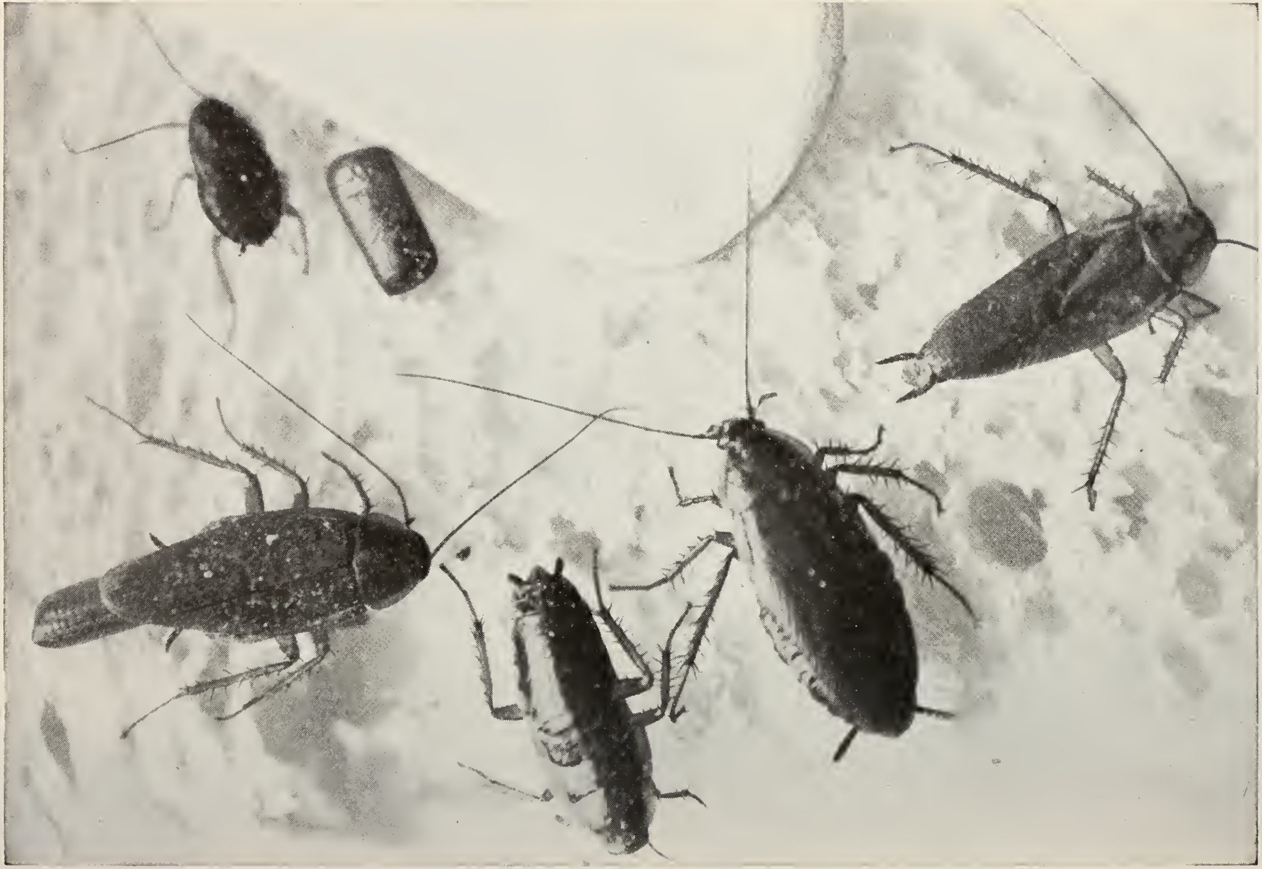


Fig. 1. Cockroaches on bread. Enlarged.

and painstaking housekeeper, therefore, who aims at cleanliness in pantry and kitchen, has the advantage over one of more easy-going habits.

Powdered borax in some form appears to be the chief agent to be used against them, and probably forms the base of many of the well advertised and rather high priced roach powders.

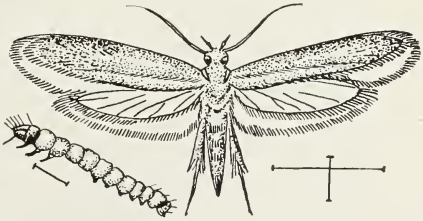
A private house badly infested, where the housekeeper followed the advice of this Division, was completely freed of the pest by a faithful and continuous use of powdered borax. This was scattered along the mop-board in the kitchen, about cracks and crevices wherever they occurred, in kitchen drawers, about the water pipes, kitchen sink, etc., every evening after the day's work was finished, and continued for about a week.

F. L. W.

CLOTHES MOTHS.

To keep furs, woolens, feathers and skins safe is a matter of eternal vigilance. Articles in frequent use, and rooms frequently swept and aired, and where plenty of sunshine has free access are shunned by the clothes moth. Clothing and furs should be hung out in the bright sun light at least once a month for several hours.

A method now much adopted is to enclose woolens and furs in large paper bags, which are made for the purpose. These bags may be made of either ordinary heavy paper or tarred paper, and can be purchased in many sizes. They seal up perfectly tight, and if no moths, eggs or larva are present on the material when placed in the bag, it will remain perfectly safe all summer. Bags made of heavy unbleached cotton cloth, or muslin, are also good. These can be sewed up on the machine and will keep out all moths.



Clothes Moth and larva.

Chests or boxes lined with tarred building paper, or with naphthaline or camphor used as a repellent make good storage places. The naphthaline and camphor are not, however, destructive to the moth in any of its stages, and the use of carbon bi-sulphide is better. Every four weeks a shallow saucer full of the liquid should be placed on top of the goods in the chest and the cover closed. The liquid volatilizes very rapidly and the gas sinks downward through the woolens and furs, destroying whatever insects are present. Remember that this gas is explosive when mixed with certain proportions of the atmosphere, so no lights, cigars or other burning material should be brought near. Also remember that the chest should be very tight. The most modern method of protecting goods from moth attacks is the use of cold storage. A temperature of 40 degrees F. will keep the moths from working; but a lower temperature is better.

C. W. H.

BUFFALO MOTH OR CARPET BEETLE.

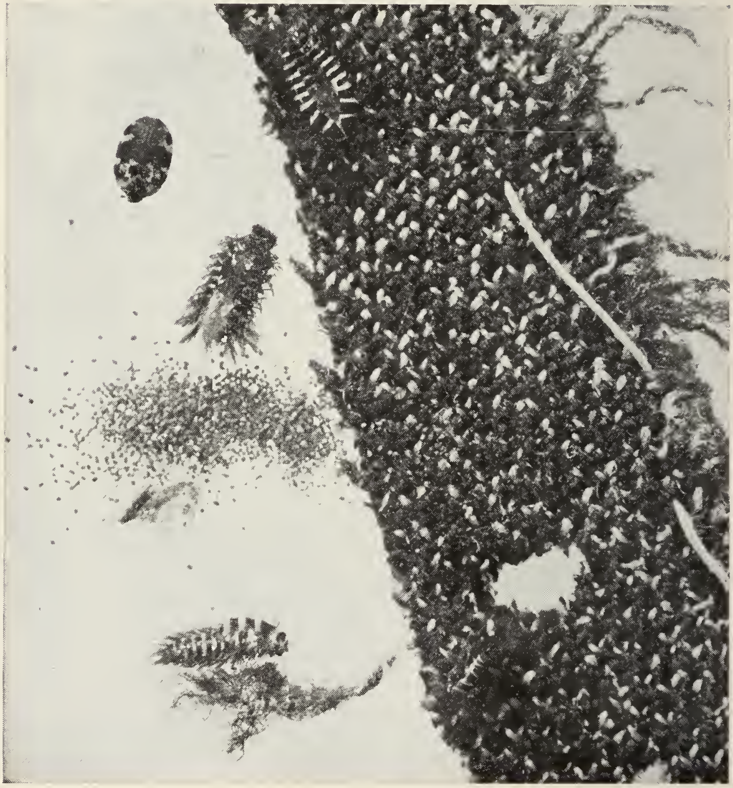


Fig. 3. Different stages of Carpet Beetle and work of the larva.

This insect seems to be fairly abundant in Minnesota. The form which is usually seen is about a quarter of an inch in length and bears transverse rows of long, brown hairs. From the rear end projects a bunch of longer bristles. It is in this larval stage that the insect does its injury. When the old-fashioned carpets were used, their chief delight was to eat out large pieces near the edges where they were nailed to the floor or to cut a slit in the carpet along a crack. Now that rugs are used more commonly, which can be taken up from the floor and cleaned at frequent intervals, these insects have been forced to attack other woolen material such as blankets and woolen garments which may be hung up in closets and left undisturbed during the summer, or which are packed away in trunks or drawers. The work in this case resembles very much that of the ordinary clothes moth. An examination, however, will show these hairy grubs in the folds of the material. Many times they will be found in the cracks between the floor and the base or in cracks in the floor.

The adult insect is very seldom seen and recognized. It is a minute beetle about $\frac{3}{16}$ of an inch in length. The background is almost black in color, spotted with white. A slightly reddish line extends down the middle of the back. When these beetles mature in the house, they fly to the windows in their attempt to get outside and may often be captured there. In the springtime, they may often be found in this situation. They feed upon the pollen of flowers such as spirea, wild cherry, and other plants. The beetles should not be mistaken for lady bird beetles which are frequently found in the house in the spring. The lady bird beetles are very much larger and usually more lightly colored and in addition are beneficial, feeding upon plant lice. They should never be killed.

This buffalo moth, as it has been incorrectly termed, was introduced into this country from Europe previous to the year 1869. In Europe, it is known particularly as a pest in museums where it feeds upon the dried bodies of insects and other specimens in the museum. It is not known there as a pest of carpets or woolen goods, but in this country has assumed that role and has spread westward from the Atlantic coast through the Mississippi valley.

The life history is something as follows: The beetles lay tiny whitish eggs upon the clothing or other material where the grubs will feed. In about ten days, these hatch and the grubs feed voraciously upon the material. The length of life of the grubs depends upon the temperature and the food supply which is present; cold weather and lack of food retarding their development. When they are full-grown, they pupate inside of the old skin of the grub, this eventually splitting down the back and finally the beetle emerges. There is probably only one generation each year in this latitude.

Where the insect has become established in a house, it requires most heroic efforts to kill them out. Careful attention should be given to floor coverings. Polished floors together with frequent removal of the rugs for a thorough beating and cleaning out of doors, leaving them in the sunshine as long as possible, will usually prevent carpet beetles establishing themselves in these places. If they attack a carpet, it should be thoroughly sprayed with gasoline. Where they are found hiding in cracks in the floor or beneath the base, a thing which occurs particularly in closets where woolen clothing has been hanging, the floors should be thoroughly scrubbed with soap and water. All the dust should be cleaned out of the cracks which should then be thoroughly sprayed or soaked with gasoline or kerosene. If possible, cracks in the floor should be closed up with plaster of Paris or in some other way, to prevent their serving as hiding places in the future. Fumes of sulphur are said to be destructive to carpet beetles if burned in the proportion of two pounds to the thousand cubic feet of space in the room. The room of course must be tightly closed and all openings closed up so that the fumes will not escape. It should be remembered, however, that the fumes of sulphur are injurious to some metals and wall papers.

The grubs may be trapped by placing old woolen clothes, particularly if they are of a red color, on the floor of closets. These can be taken out once a week and shaken over a paper and the grubs collected and destroyed. Furs and woolen garments and feathers should be stored in tight-closing chests in a manner similar to that which we employ against moths. Before the box is closed and fastened, a teacupful of carbon bisulfide should be placed in a shallow dish in the top of the box. The storing of clothing and furs in the paper boxes and bags which can be purchased in the drug stores and which are used in storing these materials, will also keep out the carpet beetles. Where clothing has been attacked by these insects, it will be well to place it immediately in large boxes and fumigate with carbon bisulfide. A box the size of a trunk will require about a teacupful of the carbon bisulfide. This chemical will evaporate slowly and the fumes sink downward through the material, killing the grubs and any beetles which may be present. The box should be made to close as nearly air-tight as possible and it should be borne in mind that the fumes of carbon bisulfide are explosive. Hydrocyanic acid gas is effectual for the destruction of carpet beetles, as well as for other insects in the house. Fumigation with this gas should be carried out under the supervision of some one who understands its nature, as the fumes are very poisonous and without great care, fatalities might result. When used with care and common sense, however, no harmful results need follow. Any one wishing to fumigate with this gas would do well to consult the writer before attempting to carry out the work.

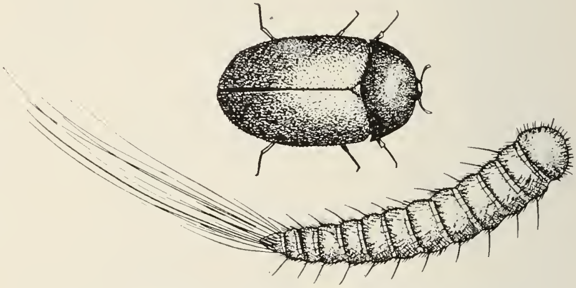


Fig. 4. The black Carpet Beetle and its larva. Enlarged.

C. W. H.

REMEDIES FOR BED BUGS.

1. Substitute metal bedsteads for wooden.
2. Sulphur candles, not always effective, but sometimes the only thing available. Use heavy dose and place candle or candles in metal dish and this dish in a much larger vessel containing water. Close all apertures and leave room tightly closed for five or six hours. All silver, nickel, gilt

and brass exposed to these fumes will be tarnished unless removed from the room or coated with vaseline.

3. Fumigation of house with bisulphide of carbon or hydrocyanic acid gas (the latter a most deadly poison). Neither of these agents should be resorted to without consulting a specialist.

4. A most excellent remedy: Corrosive sublimate, 1 oz.; alcohol, ½ pint; turpentine, ¼ pint; thoroughly mixed. Spray this into cracks and crevices on bedsteads and elsewhere where the bugs may be secreted. Two or more applications at intervals of two weeks may be neeecssary. Label "Poison" and keep out of the way of children.

5. An old and well known method: Spray joints and cracks with equal parts of turpentine and kerosene, then fill all cracks so treated with hard soap.

6. To make them leave a bed temporarily saturate cotton wads with pennyroyal, and place in various places about the mattress.

7. Anointing one's body just before retiring with spirits of camphor will keep fleas away during the night. The same agent would doubtless work as well against bed bugs. F. L. W.

FLEAS.

Probably the chief species of flea which attacks human beings in Minnesota is the common Cat and Dog Flea, *(Ctenocephalus canis* and *Ct. felis),* and consequently, the more dogs and cats about a dwelling, or the more persistent one or more are in being present in the house, without proper precautions being taken to eliminate the fleas which accompany them, the more will dwellers in said house be troubled. The fact that immature fleas, the maggots we might call them, develop in the dust found in the cracks of a room floor, in the material which constitutes "sweepings," if they are left undisturbed for a time, explains why it is that after a protracted absence, householders frequently find upon returning to their homes, which have been closed during their absence, countless fleas, the eggs of which were left in rugs or elsewhere by infested house pets before the house was vacated.

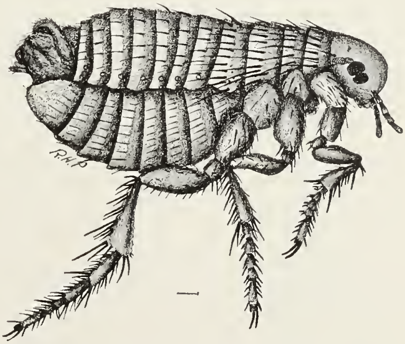


Fig. 5. Human Flea. Enlarged.
Lugger.

The writer has yet to see a dog or cat which, at some time, is not troubled with these pests, and, if proper precautions are not taken, rugs or carpets or matting are quite sure to be overrun with the pests, as well as the animals themselves.

The small white eggs of this species, about 1-50 of an inch long, are laid among the hairs of the dog or cat (according to some authorities in the bedding of the animals and not on the hairs) and readily drop off. Hence they may be distributed in any room to which these animals have access, and will be found particularly numerous in places which they especially frequent, such as rugs before the fire and the like. The maggots which hatch from the eggs in from two to four days, are white, footless, with a pale yellow head. They live in the dirt of undisturbed carpets or rugs, or beneath the same in cracks and crevices of the floor, feeding upon minute particles of decaying vegetable or animal matter found therein. They become full grown in about seven to fourteen days, spin a coccoon, turn into pupae, and in from five to eight days come forth as full grown fleas. Thus the time elapsing from the laying of the eggs to the perfection of the flea is, in round numbers from two to three and a half weeks.

Remedies.—Houses where rugs are used in place of carpets or straw matting, allowing of a frequent thorough shaking and cleaning of the rugs and a frequent and thorough sweeping of the bare floors, coupled with a scrubbing or other special treatment of the latter, are naturally less troubled than houses where the floor coverings are fastened down, thus allowing the insects to develop without disturbance. When serious infestation of a house occurs, carpets in infested rooms should be generously dusted with Persian insect powder. If this treatment is not successful, carpets and floors as far as possible should be sprayed with benzine, or gasoline, proper precautions being taken to prevent the fumes coming in contact with lights and fires during the operation and for some hours afterward. If necessary, and in addition to the above, carpets or matting should be taken up, thoroughly beaten out of doors, and the floors throughly washed with hot soapsuds, taking care to reach every crevice. Creolin or gasoline may be poured in the cracks. One writer claims that spraying a badly infested house, inside, with pennyroyal, a somewhat expensive process, will quickly drive them from the building.

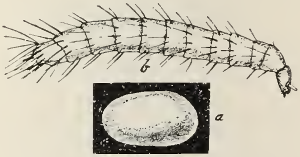


Fig. 6. Egg and Young of a Flea. Enlarged. Lugger.

The cat or dog can be made to sleep on a rug provided for the purpose, and this rug shaken out of doors away from the house, frequently, or, perhaps better than this, shaken into some receptacle, and the dust containing the eggs and maggots burned. This of itself would be a decided help.

For ridding a cat or dog of fleas, Creolin, for sale at many drug stores, is the best agent known to us. For dogs, use four teaspoonfuls of this liquid in a quart of water; for cats, two teaspoonfuls in a quart of water. Shake well and apply with the hands or a brush, or make enough to submerge the animal. The latter is the best method, holding the animal in the liquid until the fur is completely saturated. The animal requires no further washing. The fleas upon the fur will all be killed and the fur benefited. Floors may also well be treated with this same preparation, using it twice as strong as for dogs, and the animal's bedding or matting upon which it sleeps can be frequently submerged with good results. Of course, fleas will return to a cat or dog when sufficient time has elapsed after treatment as above. We must remember that neglected bedding is the chief source of trouble. If the dog or cat previously freed from fleas be allowed access to a room a few days after the room is treated as above, all surviving fleas will seek the animal for food. Thus it serves as a trap, and can be treated again with Creolin to kill the insects thus caught. An entomologist known to the writer, claims to have freed several rooms in a dwelling of this pest, by scattering four or five pounds of flake naphthaline over the floor of one room, closing the room for twenty-four hours. Then he opened and aired the room, sweeping up the naphthaline and transferring it to another room.

The writer has found, when obliged to sleep in a flea-ridden house, that, by applying spirits of camphor over his body freely before getting into a bed which was under suspicion, he was not troubled. But if any entomologist is enthusiastic enough to desire to study the habits of the genus during the night hours, he will find plenty of material to work with by attempting to sleep ("composing himself to sleep" might be a good expression to use), in one of the old log barns about which hogs roam in numbers, located on almost any mountain ranch in the Pacific Coast Range.

F. L. W.

THE SILVER FISH.

The illustration accompanying this article gives a good idea of the appearance of this insect, which, at times, is a pest in households. About half an inch long, silvery-white in color, almost fish-like in shape, quick in its movements. It is sometimes seen rapidly scurrying about among unused books on shelves not often disturbed, and in bureau drawers where clothing is stored. It belongs to the lowest order or group of insects, which ordinarily furnishes us with but few, if any, insect pests. Sometimes, however, the silver fish not only injures books, but also has been known to injure rugs made of silk, and even destroy silk dresses by eating holes in the same. It also eats holes in wall paper in seeking the starch or glue beneath it. These injuries are brought about apparently by its appetite for the glue and starch used either as sizing in cloth or paper, or in the binding of books.

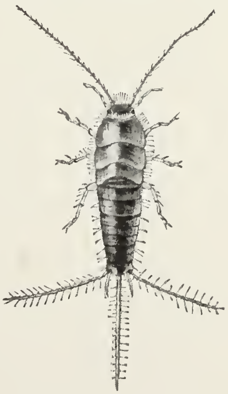


Fig. 7. A "Silver Fish."

Remedies.—Careful housecleaning in severe cases should help in eradicating or lessening the number of this pest. Dusting shelves and drawers generously with Pyrethum (Persian insect Powder, Buhach, Dalmatian Insect Powder) would be beneficial. The insect should be killed whenever individuals are met with, and it should be borne in mind that frequent handling of starched and silk clothes will tend to render the goods so handled less likely to be attacked. Since they are fond of starch, the poisoning of starch with an abundance of arsenic, smearing the same on pieces of cardboard, and placing these poisoned baits on shelves and drawers where the insects are known to occur, presents an effective means or reducing their numbers. A similar poisoned bait prepared with glue in place of starch might be equally effective, though we cannot speak as frankly of this medium as we can of the starch. Inasmuch as this insect sometimes eats the sizing off of heavily glazed paper, leaving, however, the inked parts (text) untouched, indicating a **marked dislike for printer's ink,** we recommend when silk material, or anything in fact containing starch or glue, has to be stored away for any length of time, that the same be wrapped in several layers of newspaper.

F. L. W.

ANTS IN HOUSE AND GARDEN.

At the time of year, when ants are apt to trouble housekeepers and, to some extent, gardeners, one must bear in mind that there are different kinds of ants which require different kinds of treatment. There is the large black ant, and the large blackish and reddish ant, which make large mounds in the fields, and sometimes in the lawn; then the small red ant, which makes the tiny hills, in our walks, or in the sod; and then an extremely minute reddish ant, which lives almost entirely in houses, and which once established is an awful pest.

While ants, when seen climbing up apple trees, or shrubbery and plants, generally, do not directly injure the plants, since they are for the most part after the plant lice which give up to them in response to their caresses, sweet honey dew, of which ants are very fond, nevertheless the black ant sometimes girdles and kills shrubs like the lilac and snowball.

Remedies.—When ants are girdling a snowball or other shrubbery, we first have recourse to strong tobacco water, to see whether we can drive them away. If they still persist in eating the bark, we advise uncovering the crown and larger roots, mixing up arsenate of lead with a little water, and applying it as thick whitewash to these parts. Arsenate of lead is a poison, which, however, applied in that way, would not injure the bush.

Ants in houses are sometimes very annoying. There are various ways of getting rid of them. First, one must find out from where they come, and aim to destroy the queen or queens, which in all ant colonies are the only ones which produce eggs, and as long as the queens are left living the colonies will continue to increase.

Our readers are familiar with the old-time remedy of powdered borax scattered about the shelves, and possibly are familiar with the device of putting the legs of the refrigerator or the tables holding food in pans filled with water covered with kerosene. There is also the time-honored method of filling a sponge with sweetened water, or several sponges, and putting it or them upon shelves frequented by ants, and, when filled with ants, dropping them into boiling water, and repeating the process.

Some ants in the house will eat the following poison mixture: Paris green and molasses or syrup—an abundance of Paris green. A saturated solution of alum, applied over shelves and allowed to dry, appears to leave a deposit which is obnoxious to ants, and they avoid it. One must bear in mind, however, that until the queen or queens are killed ants will continue to come.

In the case of the very minute ant, which sometimes occurs, especially in the house, we have eradicated it from a private house, where it had a foothold for eight years, by fumigation and freezing. We first traced the ants to their nest in the walls of the furnace cellar, and tried injecting kerosene, gasoline, bisulphide of carbon into the crevices between the stones where the ants entered. This did not meet with perfect success, so in the middle of the winter, with the family out of the house, we fumigated with the deadly gas known as hydrocyanic acid gas, and afterwards by opening all the windows, secured a temperature in the house something like 4° below zero for three or four days, and the ants have not appeared since, although three years have gone by since the treatment. This, as will be seen, is heroic treatment, but sometimes the exigencies of the case demand it.

Where ants are coming from the outside, and are extremely troublesome, they can be deterred from entering the house by applying with a brush a band of sticky tangle-foot, which can be purchased in cans, on the outside of the foundation of the house. As long as this is kept sticky no ant can get across it.

The large mounds out of doors, each of which is occupied by hundreds of ants, can be easily treated with bisulphide of carbon. Make eight or ten holes with a cane or croquet stick, about eight inches deep, in each mound. Into each hole pour a good tablespoonful of bisulphide of carbon, closing each hole with earth, and then throw a couple of wet burlap sacks over the hill, leaving them over night. One might have to do this twice possibly; or, in other words, until the queen or queens are killed.

The common little red ant, which makes tiny hills on our walks and in the grass, can be destroyed by pouring a little gasoline into each hole, but this is an endless job where they are numerous, and is not worth while unless they are extremely troublesome. F. L. W.

BEAN WEEVILS.

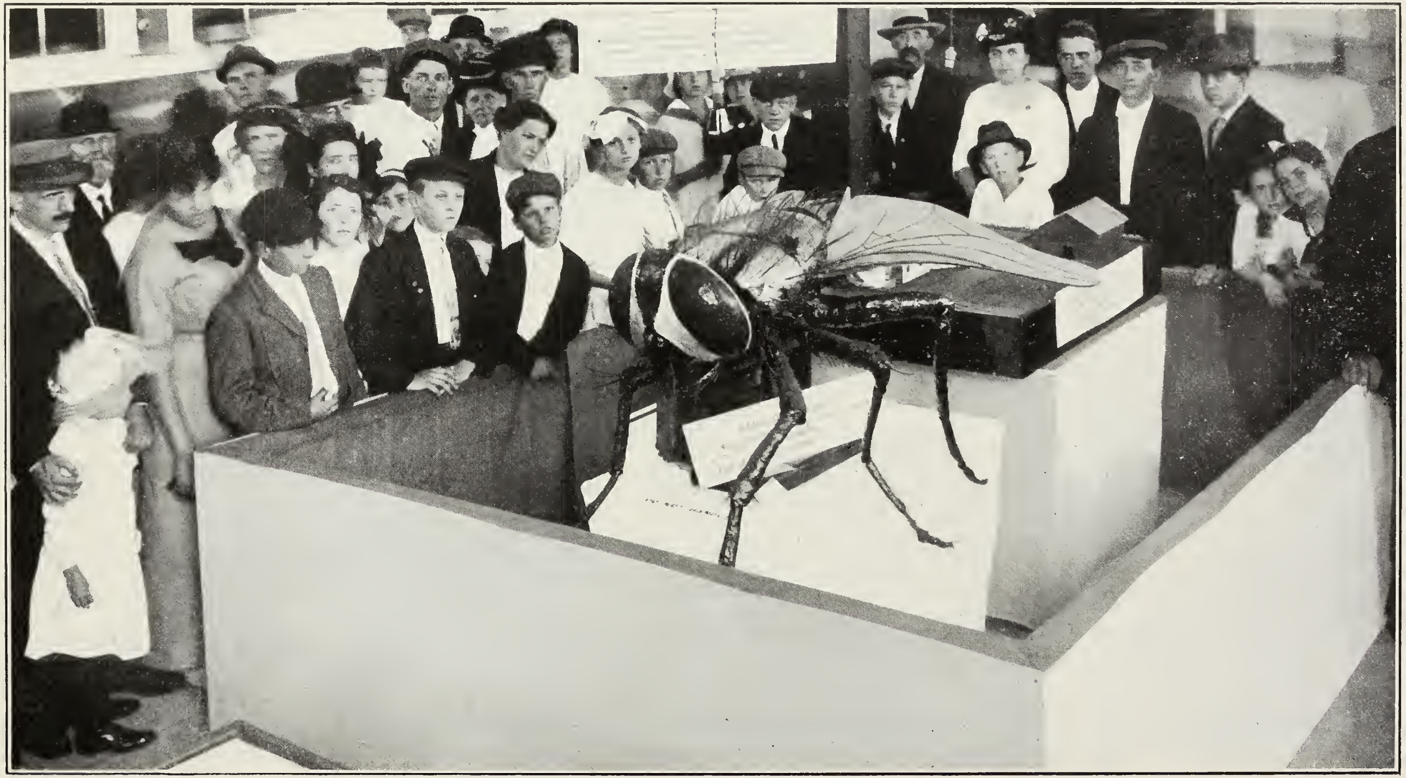
Bean weevils live and breed in dried beans which are stored for winter use. The infested beans show round holes from which the beetles have emerged. On opening other infested beans grubs will be found at work inside. The beetles are quite small—about one-eighth of an inch long, mottled and brownish in color. Infestation is carried over from old beans left in the bins from last season's crop; or eggs may be laid in the beans while still on the vines in the field—the beetles flying late in summer.

Your method of control will depend upon the quantity of beans which you have. If you have only a few and they are to be used for food, place them in an oven with a temperature of 140° F. for one to two hours. If they are for seed, place them in an air tight receptacle, such as a barrel, covering with three or four thicknesses of blanket and pour into a piece of burlap on the top of the beans a teacupful of carbon bisulphide for each bushel of beans. Leave them in the fumes of the carbon bisulphide thirty-six to forty-eight hours. **Remember that these fumes are explosive.**

If you have a large quantity of beans, which must be fumigated in a large bin or room, use three to five pounds of carbon bisulphide to each 1,000 cubic feet of space. The carbon bisulphide unfortunately will not kill the larvae and pupae inside of the beans, and a second fumigation must be given as soon as the adult weevils begin to emerge, which will be within two or three weeks. I know of nothing which will penetrate the beans to kill these immature forms, except heat. Or, in the winter time, you could use the opposite, that is, cold. If the beans had been exposed to a temperature of 10 to 20° below zero for twenty-four hours all stages would have been killed, probably.

If you are accustomed to storing beans over winter, you should see to it that your store room is thoroughly cleaned and fumigated before fall so that there will be no chance of infesting next year's crop of beans.

Infested beans and those suspected of infestation should be treated with carbon bisulphide as soon as the beans are gathered and infested beans should not be planted for seed. C. W. H.



A much enlarged model of house fly and fly—infested farm buildings. Exhibited by the State Entomologist at the State Fair and elsewhere.

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No. 46

OFFICE OF
STATE ENTOMOLOGIST
UNIVERSITY FARM
ST. PAUL. - MINN.

CIRCULAR NO. 46
JAN. 15, 1918

NOV 27 1918

THE HYDROCYANIC ACID GAS TREATMENT

FOR THE

FLOUR MOTH

(Reprint, with additions to date, and Comments upon Other Methods.)

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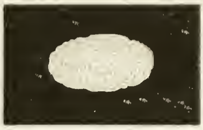
Library

EXPLANATION OF COLORED PLATE OF FLOUR MOTH

In the colored plate, Fig. 1 represents the moth enlarged three times; Fig. 2, the larva or "worm," same enlargement; Fig. 3, the pupa found in the cocoon; Figs. 4 and 5, the anterior and posterior ends of the larva, enlarged six times; Fig. 6, dorsal view of the head; Fig. 7, an abdominal foot, twelve times enlarged; Fig. 8, freshly made cocoon found in flour; Figs. 9 and 10, details of wings; Fig. 11, a freshly laid egg, enlarged twenty-five times.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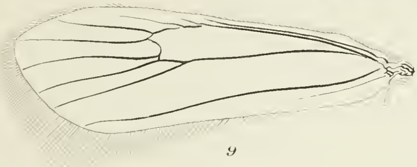
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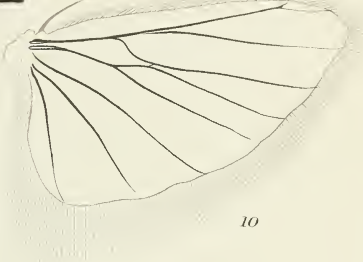
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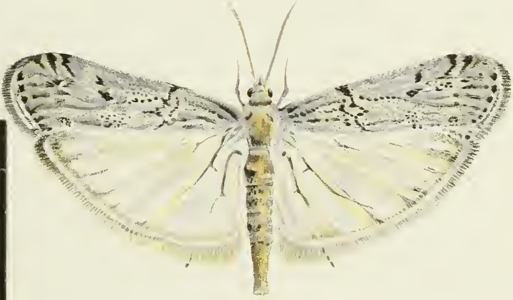
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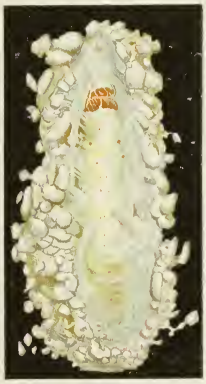
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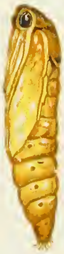
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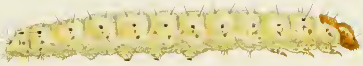
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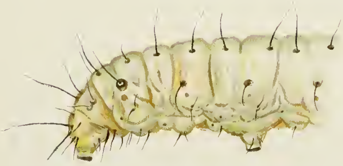
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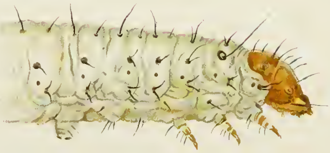
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EDITH REED, DEL. ET PINX.

A. HOEN & CO., LITH., BALTO., MD.

THE MEDITERRANEAN FLOUR MOTH

THE HYDROCYANIC ACID GAS TREATMENT FOR THE FLOUR MOTH

F. L. WASHBURN, STATE ENTOMOLOGIST.

So many requests have recently reached the Entomologist's office for information upon the method of treating mills with cyanide that a reprint of a previous circular, the issue of which is entirely exhausted, seems necessary at this time.

There is no question but that the heat method as outlined by Dean of Kansas is the safest and best measure to adopt where it is feasible. This consists in keeping all parts of the treated mill at a temperature of from 123° to 125° F. for several hours. It is not always possible to do this unless a mill is especially fitted with a heating outfit for this purpose. For this reason, and because the various other new fumigants have not been sufficiently tested, even if their cost does not make them prohibitive, the cyanide method herein described appears to be in the majority of cases the most efficient, though where the above temperature can be secured and maintained there is no question but that the heat method is most practical.

This publication will be mailed without charge to any miller requesting same as long as the issue lasts. Experiment Station Bulletins go through the mails with the Federal frank, but State Entomologist Circulars are not so privileged. Applicants, therefore, should accompany their requests with a two-cent stamp.

It is to be noted that it is practically impossible at this time to purchase cyanide of potash. Fortunately we have an excellent substitute in the shape of cyanide of sodium which gives quite as effective results and is less expensive than the potash compound in that one requires only four-fifths as much cyanide of sodium as cyanide of potash for fumigation. For example, it is necessary to use only four-fifths of three pounds, or 2.4 pounds, to a charge when employing cyanide of sodium. We would suggest, where sodium is used, computing the amount of material needed (cyanide, acid, water and jars for each story) on the same basis as with cyanide of potash and then actually using only four-fifths of this amount of cyanide of sodium, but placing the same amount of acid and water in each crock as would be used if the potash were employed. In other words, for each jar figure 2½ lbs. avoirdupois of cyanide of sodium, 4½ lbs. avoirdupois of acid and 6¾ lbs. (or practically 3½ quarts) of water.

This circular is a consolidation of all previous circulars upon this subject with additional information gleaned from results of later work. No process is absolutely perfect, and millers should not expect necessarily, particularly in the case of badly infested mills, absolute immunity after the first and only treatment. The inexpensiveness of the process, and the fact that the gas at the strength used is non-explosive, and the further fact that it in no way injures dry mill products, makes it by far the most effective remedy available. Its poisonous qualities, of themselves, make it safe in the hands of those acquainted with it, for the knowledge of the possibly fatal results from careless manipulation insures extreme care in its use. Under such conditions it is to be regarded as a safe agent, but it should be borne in mind, not only that the cyanide of itself is poisonous, but also that one good whiff of the gas engendered by the contact of acid and cyanide might produce fatal results. Drinking water or moist food of any kind should not be exposed to the fumes. Bright steel may be slightly tarnished if not protected.

Summing up the advantages of the hydrocyanic acid gas treatment it may be said:

1. It is always available and not expensive.
2. It is a method of relief for mills outside of the "freezing" zone, and freezing is by no means an absolute cure.
3. Its use at the strength indicated is absolutely safe as regards fire or explosiveness.
4. It is absolute death, at strength used, to eggs as well as the other stages in the life of the flour moth.
5. Rats and mice perish if they come in contact with the fumes.
6. Its deadly qualities of themselves call for such extreme care in its use as to insure safety. In other words, in the hands of those acquainted with its nature and its use, it is a safe agent.

The Method Briefly Described:

Certain conditions are necessary to insure successful fumigation. In the first place the environment of the building to be treated is of importance. Manifestly, if it is one of a block of buildings, or if there is another building owned by a different party directly contiguous, in either of which cases the gas might penetrate where it is not desired, the permission of the owner of such property should be obtained, and precautions taken to prevent accident. When a mill stands by itself at a distance from other buildings with which it is in no way connected, no such preliminary precautions are necessary.

Secondly, the building to be fumigated must be fairly tight. If windows are very loose, paper should be pasted over the cracks. Further, when possible, if the stories to be fumigated are not separated from each other, some temporary inclosure should be made, thus insuring each story getting the maximum amount of gas.

Find *accurately* the number of cubic feet in each story to be treated, making no allowance for machinery or empty bins. Allow .25 of a gram of cyanide for every cubic foot of space. After multiplying the number of cubic feet by .25 divide by 28.35 to reduce to ounces, and this result by 16, the final quotient being the number of pounds (avoirdupois) of cyanide needed. But experience has taught the writer that it is well to use two or three jars more on each floor than the above specifications call for to insure thorough work, hence it is wise to add nine or ten pounds more for each story, when making up your order. The amount of cyanide required having been determined, order it from a reliable dealer, *insisting upon 98 per cent or 99 per cent grade of fused cyanide of potash*. Avoid the use of a low grade.

The employment of cyanide of sodium in place of cyanide of potash has been discussed on page 3. The trade name "Cyanegg" is used to designate egg-shaped masses of cyanide of sodium now on the market, each piece weighing one ounce. This is a convenient form in which to use this material.

A half more sulphuric acid, liquid measure, than cyanide will be needed. For instance, if a building require 500 lbs. of cyanide, 750 lbs. of sulphuric acid are called for. This acid must be the *best grade of commercial acid with a specific gravity of 1.83 or over. Anything below that should be rejected.*

Three pounds of cyanide (a convenient-sized charge) to a crock calls for 4½ lbs. avoirdupois of acid, and 6¾ lbs. avoirdupois (approximately 3½ quarts) of water to each crock. *The water should always be poured in first, and the acid added.*

Get from a grocer a hundred or more manila sacks, No. 8 or No. 10 or No. 12. You will need two sacks for every three pounds of cyanide. Do not use the heavy paper sacks, so-called "sugar sacks." Cloth sacks must never be employed. These bags are to be doubled, one being carefully placed inside another. The cyanide, after being broken up, is placed in these sacks within an hour or two of the time when it is to be used; but must not be left in the sacks for any length of time, four hours, or over night, for example. Torn sacks must be rejected.

When ready to fumigate, but not before, this cyanide is done up in 3 lb. packages,* using double manila bags, i. e., one inside another, of such size as to permit the paper to be brought together and securely tied above the cyanide without tearing. If cyanide of potash is left too long in paper sacks in a more or less humid atmosphere it absorbs moisture and the sacks are rendered insecure. As many 4-gal. crocks should be rented or purchased as there are packages of cyanide. If, however, the entire plant is not to be treated at one time, only sufficient jars are needed for the portion to be treated, since the same crocks can be cleaned and used again. These crocks after being thoroughly cleaned are in no way injured for household use later by being thus employed.

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*Two and one-half pounds if cyanide of sodium is used.

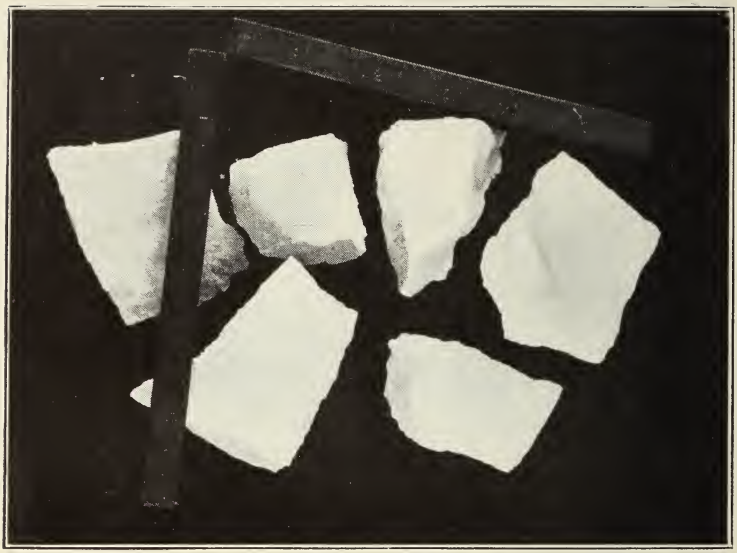

Fig. 1. Convenient size for the Cyanide.

Small mills, that is, mills in which there are not more than ten or twelve jars on a story, can be treated by dropping the charges by hand. We find that under ordinary conditions prevailing in mills, about twenty-five seconds elapse between the dropping of the charge and the giving off of the fumes in fatal quantity. Where the floor is not too much obstructed by spouts or machinery, two level-headed men can walk rapidly from jar to jar, dropping a bag in each jar, and descend to the floor below without delay, closing the trap door, or improvised cover of building paper, as they go down. Ten jars could easily be treated thus in less than twenty seconds. In other words, the men would be in the story below before the jar first treated began to give off a dangerous quantity of gas, and as the gas always ascends, being lighter than air, operators on the floor below are, for the time being, perfectly safe. We use the expression "for the time being" because we have in mind the fumigation of all stories of a dwelling above the cellar, yet two cats in the cellar were found dead after the process.

Large mills, however, have to be strung.

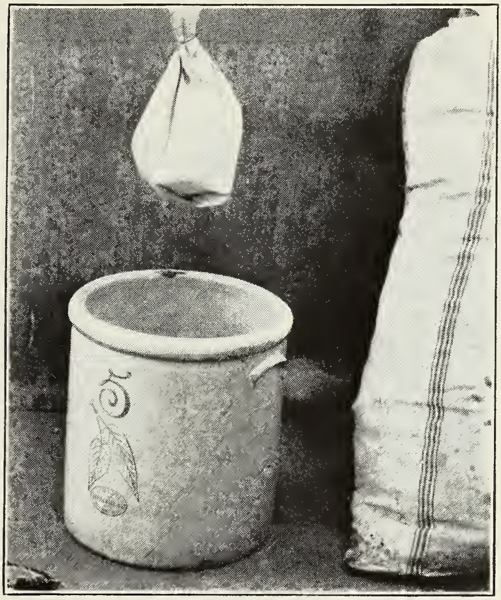

Fig. 2. The right way to hang a sack.

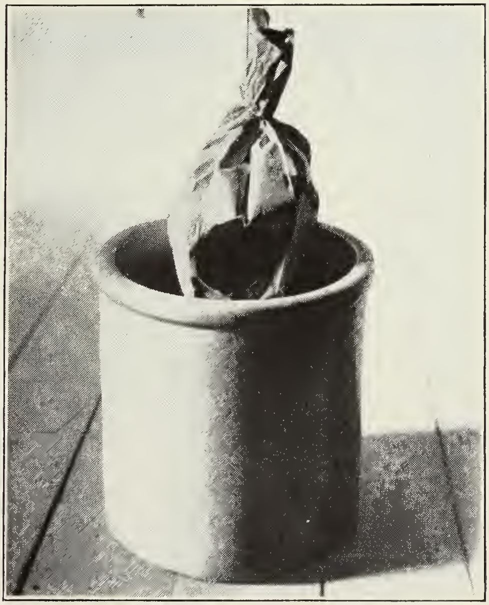

Fig. 3. The wrong way to hang a sack.

Stringing a mill consists in running stout cords (window cord is good) from the ground outside the building to various windows on each floor, one set of cords intended for lowering the cyanide, passing into the building, and the other set of cords so attached to the windows, that the latter can be pulled down or lowered, after the process, thus insuring complete ventilation before the mill is entered.

The cord by which the cyanide is lowered into the crocks, after passing through a hole in the window casing above the window is continued through a strong screw-eye fastened to the ceiling or beam twelve to fifteen feet from the window. Smaller strings, each capable of supporting a weight of eight or ten pounds, are fastened to this cord after it has passed through the screw-eye, the number of strings attached to all the cords entering a certain story corresponding to the number of three-pound packages of cyanide to be used on that floor. These smaller strings run off in various directions, in order that the charge may be well distributed, care being taken to so arrange them as to avoid friction with any machinery. These strings pass through convenient screw-eyes, each one finally hanging to the floor at the point decided upon for the placing of a jar.

The first screw-eye near the window, through which the heavy cord passes, should be large enough to receive two of the heavier cords; for, in order to insure the lowering of all packages, we tie a second cord so that it will not slip, securely to the first one, about eight feet from the first screw-eye, toward the window, pass it through the screw-eye, and attach a heavy weight to same. If the jars have been placed in position, and it is well that they should be before the next step, since they enable the workmen to locate at a glance the whereabouts of the perpendicular strings, they must be *absolutly empty*, the preparing of the acid and water being left until later.

Reliable men are now sent through the building with the packages of cyanide, and tie one package *most securely* to each perpendicular string. The package should hang by its neck a good ten inches above the top of the jar, and the men should bear in mind that the string will stretch, and act accordingly. The charges of cyanide being all tied, the next step is to place the water and acid in proper proportions in the jars. Each jar must first be moved away at least three feet from under its charge of cyanide. *The necessity for this is evident.* Careful workmen then pour the right amount of water, six and three-fourths pounds for every three pounds of cyanide of potash, or two and a half pounds of cyanide of sodium, into each jar. Then, assuming that a three-pound charge of cyanide of potash, or a two-and-a-half-lb. charge of cyanide of sodium is used in each case, four and one-half pounds of the sulphuric acid is added to the water in each jar. This must be done with care and *every precaution taken to keep all cyanide from proximity of the acid.* The fumes arising when the acid is added to the water are in no way dangerous. The next step is to carefully place each jar under its proper package of cyanide, *beginning at the top story and working down.* The bag should hang at least six inches above its jar, but not so high that it will not reach the acid when lowered from the outside of the building. The string used to suspend the bags *must be strong, and must have no weak places to invite accidents.*

Should by any chance a bag fall into a "loaded" jar by the breaking of a string, or through imperfect tying, the men working on that floor should leave the floor instantly for the floor next below, closing the door or opening through which they pass, and they must not enter that floor again until it has been thoroughly aired after treatment. Previous to this, or while it is being done, note is taken that every window is tightly closed, and it is assumed that all cats which a miller may wish to save have previously been removed from the building. The ground floor being reached, and *all men accounted for,* the doors of the mill are closed, and the charges on every floor, beginning with the top story, can be lowered by loosening the ropes connected with them and fastened outside. *Do not loosen any rope, the freeing of which will open a window.* Further, if by chance any window has been overlooked, and is found to be open after the men have left the mill, *it is not safe to let any one enter the building to correct the oversight.*

The charge is best set off at about five o'clock p. m., and the mill left closed until seven a. m. next day, guards being left about the building over night, and every necessary precaution being taken to guard against accident through carelessness or ignorance. Do not fumigate if a strong wind is blowing; a perfectly still night is most desirable.

At six or seven the following morning open all doors and windows possible from the outside. After two hours' airing the writer does not hesitate to enter any fumigated building. The first thing to do, and I prefer to do this myself, is to go over the plant and carefully remove from the proximity of the jars any charges which may not for any reason have "gone off." These bags of cyanide, if there are any, I carefully collect and remove to a place of safety. Then the workmen can remove and clean the jars. If the residue is solid, it can be removed with any suitable iron tool and it is soluble in water. After the jars are washed with hot water they are perfectly good for any purpose whatever.

Theoretically this residue is not poisonous (although it is still acid, and will burn skin or clothes), but the chemical action may not have been complete, hence great care should be used in disposing of it. A very good plan is to dig a hole in the ash heap, or in the earth, dump the contents of each jar therein, and cover the hole after all jars are emptied. The jars should afterwards be thoroughly cleaned and scrubbed.

In removing jars from the building workmen should not hold them near their faces. The movement of the crock might cause a little more gas to rise from the contents. One accident from this cause is on record.

If by any chance any cyanide should have been overlooked and should drop into a jar when a workman is by it, he and others in the proximity should leave that floor instantly, closing doors behind them. The windows being open at this time the poisonous fumes would soon be carried away.

Hydrocyanic acid gas will not penetrate large bins of grain; nor will it enter fine stuff, like flour, beyond a very short distance, an inch possibly. It therefore behooves a miller to take away and burn any refuse fine matter on the floors or in the spouts which he has reason to believe infested. Marketable mill stuff, bran, etc., in sack, should be shipped before treatment or immediately after, that the mill may not be reinfested from possibly contaminated material.

All machines, spouts, elevators, etc., should be left open to allow of free entrance of gas. This gas is lighter than air; it rises; therefore, it would not be safe for one to drop packages of cyanide into jars of acid in a basement, and then endeavor to leave by *ascending* stairs. Hence, even when we drop by hand, we frequently string the basement.

What Constitutes Success in Treating a Mill. It must be borne in mind that a mill sufficiently infested to call for treatment necessarily contains many thousands of the moths in some stage. A few "worms" or pupae, concealed in some crack on the side of a window or elsewhere may escape the deadly fumes, but the finding of five, ten, or twenty live worms after the fumigation by no means indicates failure. Far from it for, eliminating all unfavorable conditions, it might take several years for a mill to become sufficiently reinfested from this source alone to need another treatment.

The above is, in brief, the method of procedure in fumigating mills for the flour moth. The gas is a safe and more efficient agent when used with care by those familiar with its nature. One good whiff of it, however, would probably be fatal to any human being, *hence, its use should never be entrusted to one not familiar with it. Its presence can be detected even in minute quantities by its odor which resembles that of the kernel of peach pits.*

The writer is in receipt almost daily of statements from millers testifying to the efficacy of this method; a few of these are repeated here:

From the owner of a badly infested mill:

"The work seems to have been a success, and we certainly could not have continued running without the treatment. I have been around the mill this morning making a personal examination of the results of the work; have taken out of spouts a large amount of webbing and worms, and on a careful examination do not find a single live worm or moth, and some of the masses in the spouts were possibly an inch thick."

Another mill owner, whose plant was perhaps one of the worst in this connection I had ever seen, says:

"The process seems to be a most successful one where mills are infested with various pests."

The head miller of a seriously infested milling plant in Illinois writes after fumigation:

"I have not seen one now in two months, and am keeping a sharp lookout for them all the time. This seems a remarkable condition to one familiar with the premises and knowing how well they were established in the mill."

Another miller writes: "We have been using hydrocyanic acid gas for a number of years with very satisfactory results." An Illinois firm writes after treatment of the mill: "The Monday following * * * we cleaned out everything thoroughly, and at that time found just one live moth. * * * We are well pleased with the result of fumigation, and have nothing to regret except the fact that we did not go at it four years ago."

Another: "Have used this method in our mills for the last four or five years, and find it very satisfactory, especially when care is taken in making proper preparations."

One of the best proofs of the efficacy of this method was shown in the fact of a very badly infested Illinois mill remaining absolutely free of the moth for fourteen months after being fumigated, at which time the mill was closed because of the owner giving up the business. This can mean but one thing, namely, that every stage of the flour moth in that mill, including the eggs, was killed by the process.

A miller must not expect, however, that one treatment will necessarily eradicate all and every pest in the mill; figuring the amount required may not have been accurate, or the mill may not have been properly cleaned beforehand; or it may become re-infested from some source. A few of our mill pests do not yield readily to this treatment, which is so efficacious against the flour moth. Fortunately they are not insects which are particularly troublesome. We frequently find some of the little red beetles, flour beetles, and sometimes erroneously called "weevils" alive in a mill after fumigation; the same is true of the flattish, yellowish brown "worms" (meal worms) which later turn into black beetles. These two pests are apt to bury themselves in inaccessible places, and in the midst of fine stuff, thereby precluding the possibility of the gas reaching them. However, these insects are of minute importance compared with the flour moth, against which this process is especially directed.

A few observations made in the course of our work, and certain precautions may well be given here for the information of millers.

1. *Size of lumps of cyanide makes but little difference, except that the pieces, as shown in the illustration, Fig. 1, are of convenient size for doing up in bags, that is, the corners do not push through the paper as readily as do the corners of large pieces.*

2. *Hot and cool acid appear to act with equal rapidity upon the uncovered cyanide, but the temperature of the liquid makes a great difference in the matter of penetrating a double paper sack—the cooler liquid penetrating the paper much more slowly.*

3. The make of sacks appears to cause no difference in time required for acid to penetrate to cyanide, as long as they are of manila, and are not of the heavy material, such as is used for sugar sacks. The latter should be avoided. Cloth sacks should never be used.

4. Mills should never be fumigated for less time than over night.

5. Twenty-five seconds elapsing between the dropping of the cyanide and the first giving off of gas in fatal amount is a conservative time estimate, resulting from practical tests with the liquid at a temperature of 140° to 180° F. This will be approximately the temperature of the liquid up to one-half hour after mixing the acid and water, with the mill at ordinary temperature.

6. Experiments in the laboratory and practical work in many mills indicate that eggs of the flour moth are killed by this gas, and that other stages of the insect are reached and killed even when covered by an inch or more of webbing.

PRECAUTIONS.

1. Calculations as to the cubical contents of each floor to be fumigated must be absolutely accurate.

2. Get only the best material; a poor grade of cyanide and acid cannot be relied upon.

3. Put on the work only a few picked men, selecting them from amongst the most intelligent of your employes.

4. Take every measure possible to prevent the cyanide from coming in contact with the acid until the critical moment when such contact is desired. Be sure that each step of the process has been carefully studied before hand. Do NOT hang bags as shown in Fig. 3.

5. Provide for thorough ventilation from the outside. Do not enter the mill until it has been well aired for at least two hours.

6. Removal of the jars from the building after the operation, and the disposing of the residue in a safe place calls for care, and should not be intrusted to men who are careless or ignorant as to the nature of the gas. They should be cautioned to avoid a jar which bubbles, and should at all times keep their faces away from the jars they are handling. This residue, if the chemical action has been complete, is not poisonous, but it is acid and it is always best to "keep on the safe side." It should, therefore, be placed where it will do no harm.

7. The lumps of cyanide, when placed in the bags, should be approximately between two and four inches in diameter.

8. If one must deal with returned sacks they should be fumigated before being placed in mill, as they are a prolific source of infestation.

9. Use four-gallon jars, never three or five, if it is avoidable. Three-gallon crocks frequently boil over, and five-gallon crocks are unnecessarily large and expensive.

10. For his own satisfaction in doing the work thoroughly, and for the safety of his employes, no miller should undertake this operation without having first become conversant with every step of the process.

11. Hydrocyanic acid gas penetrates readily through small cracks and crevices. A mill in close juxtaposition with another building not controlled by the miller, or within ten or twelve feet of another building occupied during the process, would present difficulties.

12. Although this gas is not explosive at the strength above recommended, it would appear to be a desirable precaution to turn off lights and draw fires (if the boiler or engine room are included or are reached by the gas) before the operation.

13. In ordering material get more than enough, for if one finds himself short at the last moment, and is at a distance from the source of supplies, he certainly is in a predicament. Further, order *in time.* Railroad companies will not ordinarily freight acid in carboys with general merchandise; they may hold the acid several days or a week, waiting for an oil car.

Fig. 4. Steam rising from crock due to heat caused by chemical action of acid on the Cyanide.

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No. 51

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CIRCULAR NO. 51
MAY 1, 1918

FRUIT TREE CANKERS AND THEIR CONTROL

BY

E. C. STAKMAN AND A. G. NEWHALL, DEPARTMENT OF PLANT PATHOLOGY AND BOTANY, UNIVERSITY OF MINNESOTA.

NOV 27 1918

During the last few years cankers have been doing considerable damage on fruit trees in Minnesota. They have been particularly destructive on apple trees. Plum and cherry trees have also suffered somewhat. The average Minnesota orchardist does not pay much attention to cankers. The trees are quite often sprayed in the ordinary manner and, aside from the regular pruning, little more attention is given them. The trees must be carefully watched and very well cared for if losses from cankers are to be avoided. It is therefore important to know the nature of cankers, the method of their action, and the means for their control. Every apple tree should be made to yield to its maximum capacity; therefore, everything possible should be done to maintain the health and soundness of the orchard.

WHAT IS CANKER?

Canker is a popular term which is applied to certain types of injury on woody plants. It is usually applied to the death of the bark, followed quite often by a callus formation around the edge of the dead area.

OCCURRENCE OF CANKERS

Cankers may occur on any woody plant, but in this paper only those on fruit trees are discussed. They may occur on any woody part of the tree, being found frequently on twigs, limbs, and trunk, and quite often in the crotch of the tree.

DAMAGE FROM CANKERS

Cankers may cause general unthriftiness of the trees; or the death of the twig, branches, or even of the whole tree, depending on location, size, and kind. In addition to the damage caused by the cankers themselves, they are dangerous because they often allow the entrance of wood-rotting fungi which may be unable to get into a healthy, living part of the tree, since many can grow only on dead wood. When the canker has killed the bark, however, the natural protection of the tree is destroyed. The wood-rot fungi can then easily get into the heart wood and rot it, thus weakening the tree considerably, or may get into the sap wood (living wood) and kill it. (See Figure I.)

KINDS OF CANKERS

There are several kinds of cankers commonly found in Minnesota. Among them the most important are those often referred to under the general term of winter injury, sun scald, or crown rot; fire blight cankers, Figure II; black rot cankers and numerous others.

CAUSES OF CANKERS

Cankers may be caused by the weather. The exact reason for this injury is not known. The wood may be winter killed by drying or the injury may occur as a result of alternate freezing and thawing.

Mechanical injury may often cause cankers. Branches may rub together and wounds result. (See Figure III.) When a tree is poorly shaped in pruning, the limbs may be so long that the swaying of the branches caused by the wind may injure the crotch and cankers and wood rots follow.

Wounds caused by careless pruning or careless cultivation may serve as points of entrance for canker-producing fungi. (See Figure IV.) Animals, particularly mice and rabbits, very often cause cankers on trees. If the injury is not too great, these may heal over rapidly. If it is quite extensive, however, wood-rotting fungi may enter the dead areas.

Some of the worst cankers are caused by fungi or bacteria. The brown rot of plums and cherries, which causes the fruit rot, may also cause cankers on the twigs or even on the larger

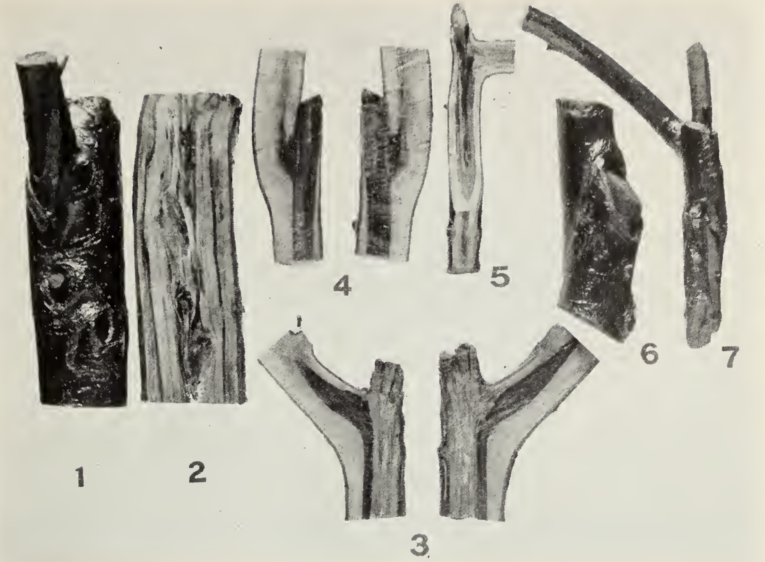

Figure I—Stubs left like these nearly always result in the entrance of canker producing organisms as in 1, 6 and 7, or wound rotting fungi as in 3 4 and 5, or both. Note how weak 3 and 4 must be. (Courtesy of W. G. Brierley.)

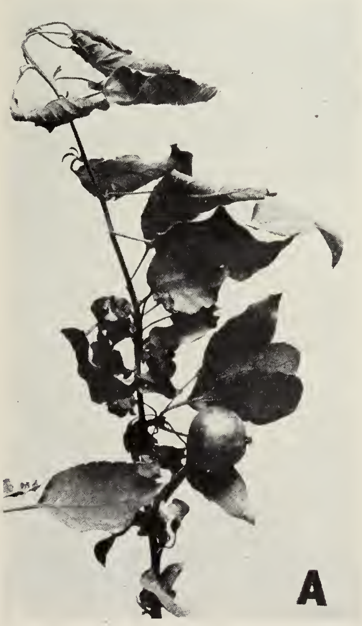

Figure IIA—Fire blight on tip of apple twig. It often works back very rapidly in a short time, forming large cankers in the main branches and trunks.

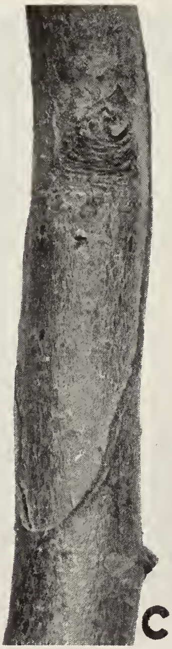

Figure IIC—Branch girdled by fire blight canker. Note smooth surface of cankered area and deep cracks at margin. This was cut in December.

branches or trunks. This is quite often followed by the gum formation commonly seen on both plums and cherries. The common fire blight which has been serious in Minnesota in recent years may cause serious cankers on branches and trunks of apple trees. The black rot fungus, responsible for the black rot of apples, also causes cankers on the woody parts of the tree. Black rot cankers are especially serious following fire blight.

CONTROL OF CANKERS

After a canker is once formed, control measures, regardless of the primary cause, are quite similar. However, getting rid of cankers after they have once formed is much more difficult than preventing them.

If an orchard is kept perfectly healthy and all wounds are immediately protected, there is not much danger that cankers will get started. The first essential, therefore, in preventing cankers is to control all diseases. On plums, brown rot should be thoroly controlled. Details for the control of this disease are given in Minnesota Bulletin 153, also in the Minnesota Horticulturist (Vol. 43, pp. 231-233; and Vol. 44, pp. 144-151). Black rot of apples can be controlled very largely by proper spraying. (See Minn. Bul. 153, pp. 26-27.) Fire blight can be controlled only by keeping the orchard clean and cutting out the blight from all trees. TO GUARD AGAINST THE SPREAD OF FIRE BLIGHT BY PRUNING, THE TOOLS USED IN THE OPERATION MUST BE WASHED OR DIPPED IN A 1 TO 1,000 SOLUTION OF CORROSIVE SUBLIMATE BETWEEN EACH CUT.* Dormant washes may help somewhat, but it is doubtful whether the application of the dormant wash pays in Minnesota.

Much trouble can be avoided by proper pruning. (See Figure IV.) Whenever trees are pruned, the wounds should be clean and near the surface of the trees. Stubs should never be left. Wood rot and canker fungi very often enter them. Cut off suckers in order to prevent the rapid development of fire blight. All dead material should be promptly removed and burned. The trees should be properly pruned in order to provide good aeration so that the canker fungi will not get started so easily.

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*Directions for making this solution can be obtained from any druggist when the material is purchased. Corrosive sublimate is a deadly poison if taken internally.

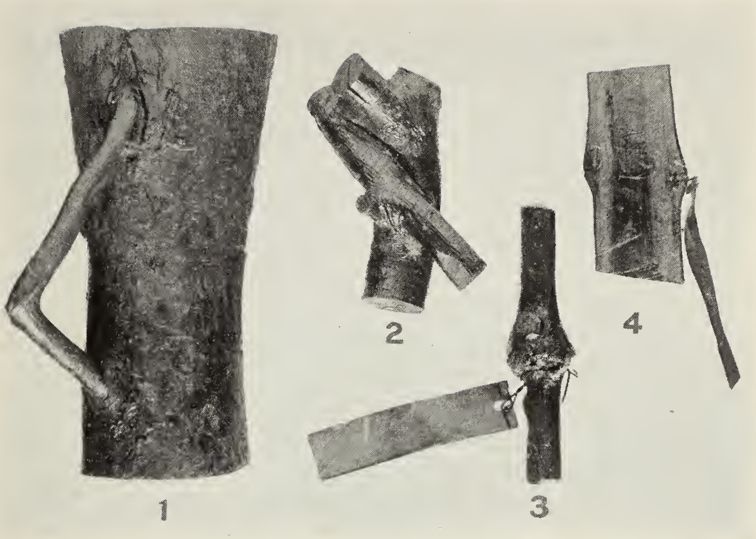

Figure III—Mechanical injuries furnish places of entry for canker producing and wood rotting fungi. (1) Small branch grown into a crotch. Note margin of canker at bottom. (2) Crossed branches. Note very small fruiting bodies of canker producing fungus. Note (3 and 4) the abnormal growth from choking effect of wire girdle. (Courtesy of Mr. W. G. Brierley.)

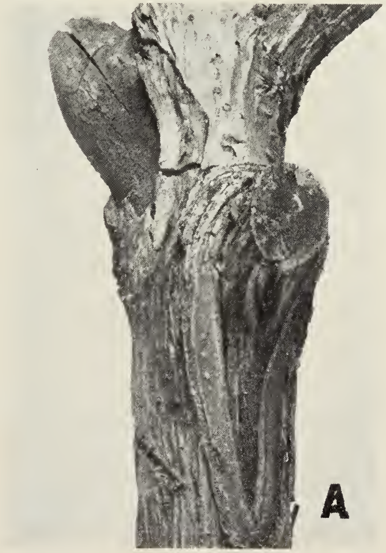

Figure IV—Careless pruning. This branch was killed by fire blight. These wounds would never heal properly, but would always present a place for entrance of wood rotting fungi. See Figure I.

Cankers sometimes are found on nursery stock. Whenever nursery stock is purchased, therefore, it should be thoroly inspected by the grower before being set out. Any suspicious looking cankers should be examined by a competent person and if they prove to be of a dangerous nature the tree should not be planted.

After cankers are once established, they can be controlled only by tree surgery. Regardless of the origin of the canker, the general principles of control ought always to be the complete removal of the dead areas. Whenever small branches have serious cankers they should be cut off far enough below the external visible indications of the canker to insure getting rid of all diseased material. Whenever branches are cut, the cut should be made parallel with the surface of the part of the tree from which the branch is growing. This may sometimes make a longer cut but healing will be more rapid if the wound is properly made, even though it may be larger. The surface should always be smooth. Jagged surfaces allow water to accumulate and make the process of healing difficult, and also allow the entrance of wood-rooting fungi. Long stubs should never be left. They are often the source of much annoyance and danger. If the wound is large it should be properly protected. If it is small, that is, not over an inch and a half in diameter, it will usually callous over if properly made. When cankers occur on very large limbs or on the trunk it may not be advisable to remove the entire limb or the entire tree. The canker can quite often be cut out. (See Fig. V.) Whenever this is done the cut should be long and pointed at both ends in order to aid in healing. The work should be done with a very sharp knife and the cut should be perpendicular to the bark, not slanting. (See Figures V2 and V3.) All dead wood should be removed. If it is not, the canker will continue to spread. After the removal of the dead area the wound should be protected. (See Figure V4.)

WOUND COVERINGS

Whenever large wounds are made either in cutting out branches or cutting out cankers on large limbs or trunks, they should be properly protected. A good wound dressing ought to be cheap and easy to handle and should be a disinfectant as well

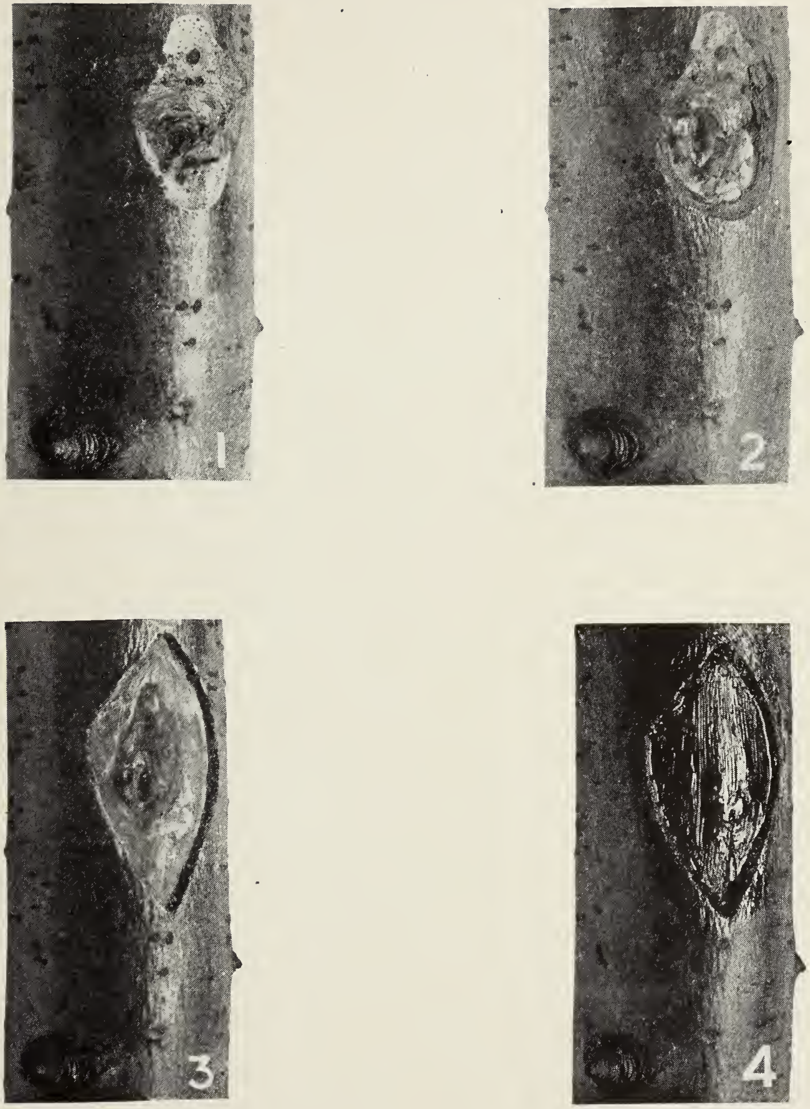

Fig. V. Fire blight canker and treatment.

1. Canker.—Apparently gained entrance through a spur.

2. The wrong way to cut out the canker.

3. The right way. The cut should be made with a sharp tool, perpendicular to the surface of the bark, and pointed at the top and bottom.

4. Treated Wound.—All diseased portions should be removed and disinfected before protecting with gas tar.

as a preservative. Paint is often used in Minnesota orchards but is not very satisfactory. Recently coal tar has been used very successfully. Coal tar can be obtained from the local gas company and is cheap and easy to handle.

TREE SURGERY FOR WOOD ROTS

When any part of a tree has begun to rot the decayed portion should be removed. Unless a person is experienced in this kind of work it may be well to procure the services of a reliable tree surgeon. The general principle to be followed, however, is the same as that to be followed in the excision of cankers. All of the rotted portion should be removed. After the removal of the rotted wood the tree should be strengthened by some wound filling. Dry sawdust and asphaltum have been used successfully. The cavities made are filled with the mixture in the proportion of one part asphaltum to from three to six parts of sawdust. Tree cement is often used, but is so rigid that it is sometimes undesirable.

Prompt attention to canker control may save considerable trouble in the future. Watch your trees carefully. Whenever cankers appear cut them out, in order to protect the rest of the tree and the rest of the orchard. Burn all diseased material to prevent the spread to other trees in the orchard. Control diseases, protect wounds, prune the trees properly, and do not let cankers get started. Keep them in check. When an orchard is once badly infested with cankers and wood rots, the work of cleaning up is rather discouraging. It is much easier and more economical to prevent the development of cankers than to remove them after they have once become established. Conditions are rather serious in Minnesota now because of the attacks of fire blight during 1913, 1914, and 1915, resulting in much dead wood. Black rot cankers followed very closely on the attacks of fire blight, and wood rots are following closely on the attacks of black rot. Clean up the orchard now and keep it clean in the future. For further information write Plant Disease Department, University Farm, St. Paul.

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